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BRIEFLY TOLD.

THE AMESBURY HEARING.—In our mid September issue we gave a report of the hearings before the Massachusetts Gas Commission in respect of applications which had been made to that body by certain named gas companies for permission to engage in the manufacture and supply of water gas. At the same time the Commissioners received a communication from certain residents of Amesbury in which it was set forth "that the local gas company was engaged in the manufacture of water gas; that the gas was represented as being detrimental to health; that several trees had died along the line of gas pipes, etc.," the communication closing with the request that the Commissioners sit at Amesbury for the purpose of inquiring into the matter.

The Commissioners designated Sept 28th as the time for the hearing; on the morning of which date the full Board assembled in the Amesbury Opera House. A large audience was present. Chairman Coffin opened the proceedings by explaining the purport of the gathering, and after the difference between the content of carbonic oxide in coal and water gas had been pointed out, Dr. Leslie, President of the Local Improvement Society, testified to the decay of a large number of shade trees that had been planted along the lines of the Company's mains, while other trees, off of the lines, but planted at about the same time that the defunct trees were placed, thrived very well. About 200 trees in all had been set out, and the mortality in them invariably occurred on the gas lines. He did not claim that the trees suffered solely because the gas that attacked them was of the variety known as water gas, and would not deny that coal gas would cause a similar result. Speaking as a physician, however, he thought water gas was a deadly compound. He thought the matter could be remedied by having perfectly tight mains. Mr. J. H. Hill, an employee of the Improvement Society, testified that, in his occupation of gardener, he had set out trees in Amesbury for 25 years, and had seldom lost one until the past season. Six trees in front of the Bailey residence, planted a year or two ago, all died. He dug one up, and noted a strong smell of gas about the excavation. The roots of the tree so dug up were shriveled. He had planted over 200 trees, and knew of but two of these, away from the lines of pipe, to die. From 20 to 25 were lost along the mains. Then followed some testimony as to whether or not a gas escape had fouled the water in a public well at the head of Main street—the evidence given by one Jno. Morrill in this respect being very amusing, to say the least. Morrill gave it as his opinion that the gas company and the water company were not in reality separate corporations, and that they polluted the well in order to gain consumers for the liquid section of the enterprise.

Mr. Biddle, on behalf of the Gas Company, admitted that a leak in the mains had been repaired in front of the Bailey residence, and while also admitting that the gas might have caused the decay of the trees planted at that point by gardener Hill, he (Mr. Biddle) thought that a sufficient quantity of gas of any kind would have had the same effect. He said that the Company was still using some of the old mains that had been jointed in cement, but that if all the work were to be done over again he would certainly employ lead. Having explained that the complaint emanated from Mr. Cate, of the Improvement Society, he (the witness) wanted it understood that his Company did not desire a license to kill

trees or to cause any nuisance, and that he was as much interested in preserving the beauty of the town as anyone else. He, however, owned one-third of the stock in the Gas Company, and if it was not allowed to manufacture water gas, why, no gas of any sort would be made. He closed his remarks by saying that the unaccounted-for gas charge last year was 13 per cent., and that nine-tenths of his customers were perfectly satisfied with the quality and safety of the gas supplied them.

Mr. Bartlett thought that faulty mains caused all the trouble, which would be dissipated when the necessary repairs were made. He, however, thought the water gas now made by the Amesbury Company had a much worse odor than the coal gas formerly supplied. Mr. R. T. Briggs a large holder of stock in the Company, thought the unusually severe frosts of last winter were responsible for the breaks in the mains, but the work of tightening the same was being prosecuted. Mr. Currier, who had used gas for over 25 years, was in favor of water gas. It was better than coal gas—he had in his occupation, as a plumber, worked over all sorts of mains and services, and thought water gas as safe as any. This remark elicited the statement from Dr. Douglas that he thought water gas was a good illuminator, and used it in his house, but he would not feel safe with it were the burners under the care of another than himself.

The chairman then concluded the hearing by remarking that more care should be taken with joints, pipes and fixtures when water gas is used than in the case of coal gas. The greater the content of carbonic oxide the greater the danger. The decision will not be rendered until the Commissioners have decided what their verdict shall be in the instance of the remaining cases under consideration. There is little doubt but that the judgment will be a uniform one. The hearing, as with those that had preceded it, was conducted with great impartiality.

THE current meeting of the Society of Gas Lighting will take place on the fourth instead of the third Thursday of this month. The change from the regular day is made because of the Toronto gathering of the American Association.

CHEAPER GAS FOR KANSAS CITY, MO.—President Payne, of the Kansas City Gas Light and Coke Company, together with his associates, have redeemed their pledge of two years ago, at which time, when announcing a cut in rates, they said that encouragement from their consumers in a liberally increased use of gas would insure a further reduction at the proper time. The hour is at hand, for on the first inst. the Company issued the following circular:

"The Kansas City Gas Light and Coke Company takes pleasure in announcing that, beginning with October sales, the price of gas will be reduced from $2 to $1.80 per thousand, with a further reduction of 20 cents per thousand for prompt payment, making the net price for general consumption $1.60 per thousand.

"For stoves and engines, gas, when supplied through separate meter, will be $1.50.

"In making the above rate the Gas Company solicits the support of the public, trusting that the increase in business will justify this reduction, as we do not hesitate to affirm that we thus bring gas to a price which makes it the cheapest of illuminants, as well as the cleanest and most reliable."

Some of the doubters in Kansas City having asserted their belief that the Company's move was made because of the inroads on its business caused by the home electricians, Secretary Woolcott was applied to for information on the subject. To this inquiry he very courteously replied:

"Many of the large establishments in the city would use the electric light because they deem it necessary, no matter what the price of gas might be. We expect the increase in the consumption of gas to be large in the residence localities. There are streets in the city on which for the distance of a mile there are not a half-dozen houses where gas is burned. What we are after is the oil lamp, not the electric light. There are any number of men—mechanics, or those occupying comparatively minor clerical positions—who would be appalled at the very idea of paying $3 or $4 a month for gas, but who would gladly use it if they could obtain it at one-half the cost stated. Our new schedule will enable them to use gas, and we hope to secure a large number of such patrons. More than this, whenever the consumption warrants it we expect to enlarge our works and scale the price still further."

That is the way to speak out in meeting, Mr. Secretary—the poor man is the man for the gas companies; there are so many more poor than rich ones! Time proves that the wizard of Menlo Park struck the nail no glancing blow when he asserted that gas was to remain the light of the poor man. The oil lamp must go, and the gas man ultimately shall be its vanquisher.

THE Siemens-Lungren Company, of Philadelphia, have rented the handsome premises, No. 825 Broadway, this city, as a branch office and show room for their well-known specialties, whose worth and value have been proved by practical experience. In addition to the Company's own goods a large and varied line of the wares of the Goodwin Gas Stove and Meter Company will be displayed. The Clerk Gas Engine will also have a prominent place in the exhibit. Gas men who honor New York with a visit during their business or pleasure trips may always count on a hearty reception from the folks in charge at No. 825 Broadway.

ANNUAL ELECTION, MANSFIELD, OHIO.—At the annual meeting of the Mansfield Gas Light Company the following officers were chosen: President, L. A. Strong; Vice-President, H. M. Weaver; Treasurer, J. S. Hedges; Secretary, W. C. Hedges; Superintendent, J. S. Harris. The Mansfield Electric Light Company's annual election was then held, with the following result: President, Sharp E. Bird; Vice-President, Samuel Ulich; Treasurer, J. S. Hedges; Secretary, W. C. Hedges; Superintendent, Geo. S. Harris. No change was made in the respective boards of direction. A perusal of the two lists will be apt to convince the peruser that these companies ought to get along together on pretty amicable terms. It was supposed that the topic of establishing an incandescent plant, for which the Mansfield Electric Light Company holds a franchise, would be broached, but it was not even referred to incidentally.

WHY IT LOOKED DOUBTFUL.—The following lines from a letter recently received from Secretary and Treasurer Wilcox, of the Middletown (N. Y.) Gas and Electric Light Company, explain why Mr. W. thinks it doubtful that he will be in Toronto to-morrow:

"Your favor of the 8th inst. finds me midst the trials and tribulations of a gas man. We are laying 3,000 feet of mains, putting in a new bench, and just finishing our new 72-ft tank. The holder men are expected to-morrow. My 'grip' is packed, but it looks as if the Fates were against my going. Success to the 'Special.'"

May the "Fates" be kinder to-day than they were disposed to be a week ago; if so that grip will be unpacked in the "Queens," after all.

Packing Gas Wells.

Mr. S. R. Dresser, an expert in such matters, gives the following advice in regard to the best way to pack gas wells. He says that those who have the least trouble in packing gas wells are those who pack them at once, as soon as they are finished, not allowing the gas to go to waste for 24 hours. At that time the wall of the well is most likely to be free from any such materials as gather or adhere to it to lessen the diameter of the bore, as such obstruction is sure to occur when a well is allowed to remain for some time before being packed.

Whenever the bore of a well is made smaller by material adhering to the well it is necessary to run down a round, hollow reamer, that is dressed out the full size of the hole, to clean off this material and make the well full size again before lowering the packer. If parties have no tools and it would cost too much to get them, this can be done by taking a 4-inch tubing coupling, dressing one side of it out to the size of the hole, and running it, on the tubing, to the bottom of the well. They can then draw out and put the packer on. If these precautions are always taken there will be little difficulty in packing gas wells. One thing is certain, a packer will not go down a hole that is less in diameter than the outside diameter of the packer. When the packer comes to one of these smaller places in the well the rubber is sure to be torn, the gas will get between the rubber and the pipe and blow the rubber off, which makes it necessary to pull out and ream the hole.

The end flanges of the packer should be within three-eighths of an inch as large as the hole to be packed. If they are much smaller it leaves too much space between them and the wall of the well, so that when the well is shut in and gathers a large pressure it is liable to force the rubber past the flanges and blow it out. Especially is this true with large packers where it is necessary to use thin rubber, as in using a packer with 4-inch tubing through rubber to pack a 5¼-inch hole. The rubber in this hole is but three-eighths of an inch thick, so if the flanges are much smaller than the well the gas pressure would easily force the rubber past them. After a well is packed the tubing should be anchored to the derrick before the gas is shut in. This gives a greater pressure on the packer and forces the rubber more tightly into the unevenness of the wall. It also prevents the tubing from being blown out, as it has been in a number of cases when this was not done.

The packer should always be put just above the rock in which the gas is obtained to get the full benefit of the rock pressure and to prevent the gas from escaping through openings or porous rocks higher up in the well, as has been the case where packers have been put just below the casing, or only a few hundred feet down.

Gadd's Spiral-Framed Gasholder.

We are indebted to the English *Journal* for the following description of the improvement in gasholder construction suggested by Mr. W. Gadd, of Manchester, which matter was also referred to in our issue of Sept. 17, by Mr. Thos. Newbigging.

According to the specifications submitted to the English Patent Office the improvements relate to the construction of gasholders, and have for their object the supporting of the same, in their working position, in such a manner as to enable the external or upper guide-framing hitherto employed for the purpose to be dispensed with, and yet to give the requisite stability, although such, or a modified form of framing, may be employed in connection with the improvements when desired.

To accomplish this and to effect my improvements (says the patentee) I form the interior of the tank or well in which a holder for the containing of gas is allowed to rise and fall, in a special and peculiar manner—that is to say, affixed to, or let into the face of the tank or well, or forming part thereof, or in recesses therein for the purpose; and extending from top to bottom thereof or thereabouts are rails of metal or other suitable substance, or it may be recesses or grooves, which are formed in the shape of quick helices or spirals, or curved inclines, and (by preference) making in their total length one-quarter turn of the circle, when the holder employed is very high and telescopic. But a quicker or slower helix, or spiral, or incline may be adopted according to the circumstances and design of the same, and which may be determined by the angle of inclination adopted; 45° and 60° from the horizontal being examples of working angles, but other angles may be employed. Arranged at intervals around the circumference of the holder, close to the bottom edge thereof, or at such distance therefrom as is desirable, and coinciding with, or fitting on to the helical or spiral rails or curved inclines attached to or forming part of the tank aforesaid, are flanged or other wheels, or anti-friction rollers, of any suitable size or form, which are made to run loosely, by preference, and may be free to slide to a certain extent laterally upon their respective axles, to allow for expansion or contraction of the holder. Or block or sliding pieces or equivalent devices may be employed in lieu of wheels or rollers, or both may be combined, and the flanges may be on either or both edges. As these flanged or other wheels, rollers, or blocks, or equivalent devices rest and move upon the helical or spiral rails or curved inclines before mentioned, by preference both over and under, or between, it will be seen that, as the holder becomes raised by being filled with gas, a screw-like motion is imparted to it—causing it to partially turn as it rises, and, in similar manner, allowing it to fall by gravity as the volume of gas is reduced.

The stability of the holder lies in the fact that it is constantly, at all working heights, supported at its base or lower edge or ring; and thus presents a position of firm resistance to wind pressure or other lateral strains, under conditions somewhat similar to that of a holder placed on the ground upon its lower edge or rim.

The flanged or other wheels, rollers, sliding-blocks, or equivalent devices may either be fixed tangentially with the side of the holder, and so run upon the top, or top and bottom surfaces of the rails, or they may be arranged radially with the holder, but at the angle of spiral. Or (and by preference) the two kinds may be combined, and the rolling surface of the rails adapted thereto, or in any other suitable manner; and the rollers or sliding-pieces, or equivalent devices, when placed tangentially, may be employed above and beneath the rails alternately, or in couples or otherwise—the rails being constructed in double line, or double-headed or faced for the purpose.

The improvements are also applicable to telescopic gasholders, by employing similar helical or spiral rails, curved inclines, or grooves, within and attached to the lower or outer lift or lifts thereof, upon or within which the rollers or equivalent devices attached to the inner lift may work or move.

As a modification of the invention, the helical or spiral rails, grooves, or inclines may be employed upon a framing or cylinder within the lower or outer lift or holder itself; the wheels, rollers, or equivalents being affixed to the inner wall or face of the holder or lower lift. Or the holder or inner lift or lifts may all or in part be reversed in their arrangements of helical, spiral, or inclined rails or grooves, and their wheels or rollers; so that the latter are affixed to the tank and outer lift or lifts or in connection therewith, while the rails, inclines, or grooves are fixed to or form part of the holder or inner lift or lifts.

Fig. 1 represents an elevation, with half plan of a single-lift gasholder, raised to about its full height (and with the tank or well shown in section), of one arrangement in accordance with this invention; and Figs. 2 to 8 show examples or some variations of detail in the application of the method described.

A is the holder, and *B* the tank or well within which the holder rises and falls—riding on the helical, spiral, or inclined rails or surfaces *E*. *C* are the tangential, and *D* the angled radial rollers, which in Fig. 1 are shown arranged separately from, and altenately with, the tangential rollers *C*. By such an arrangement they may either roll on the face of the tank or well, or upon plates or rails placed at the required angle or spiral thereon. But the two kinds of rollers may be arranged together, as shown in Fig. 2, wherein the rail may be formed of channel or other iron, having a tangential roller on each side, with the angled radial roller between. Or the angled radial rollers may be dispensed with by

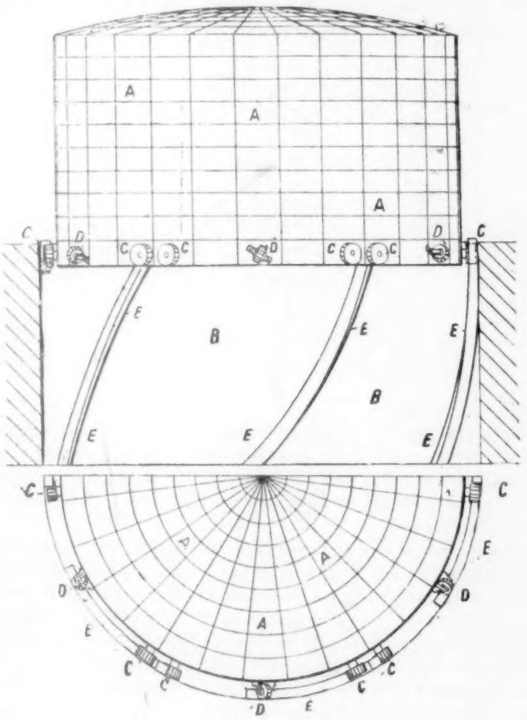


Fig. 1

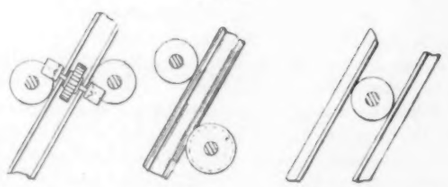


Fig. 2. Fig. 3. Fig. 4.

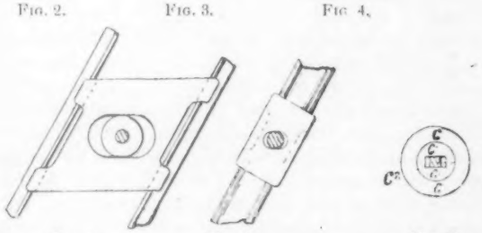


Fig. 5 Fig. 6. Fig. 7.

employing flanges on the tangential rollers; or other means may be employed for keeping the holder centrally, or the wheels thereof on the rails.

In the interests of safety, the patentee greatly prefers to employ either two sets of rollers—one above and the other below the inclined or spiral rails—or double rails with one or more sets of rollers between, in order to enable the same to securely grasp, or to be grasped by, the rails at various points around the edge of the holder; but nevertheless it may be possible, in some cases, to dispense with the under set of rollers, or the over set of rails, as the weight of the holder may be sufficient to cause the rollers to follow the inclines of the rails.

In Fig. 3 the two sets of rollers are placed one below the other, instead of in line; and one of them is shown flanged. In Fig. 4 two rails to

each roller are shown, or it may be an inclined recess in the tank or well face, by which variation the locking action or grasp is obtained by one set of rollers. Figs. 5 and 6 show two forms of sliding blocks or pieces, which may be employed in lieu of rollers, and either in conjunction or not with the angled radial rollers. To enable allowance to be made for imperfections in the construction of the helical, spiral, or inclined rails, or for the effects of expansion or contraction therein, the studs attached to the curb or ring of the holder, carrying the tangential rollers, may be arranged to have radial play within the central boss on which the rollers turn, as shown in Fig. 7, in which the tangential roller C turns on the boss C^1, having formed therein the slot C^2 to enable the projection or stud A^1, attached to the ring of the holder, to pass through; or other devices for radial action may be employed. A similar arrangement is shown for the sliding-pieces in Figs. 5 and 6.

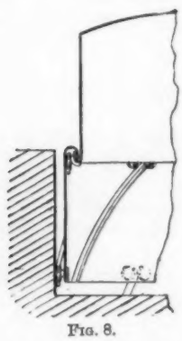


FIG. 8.

Fig 8 is a part section showing the application of the invention to a telescopic holder, wherein the outer or lower lift is provided with rails in manner similar to the tank or well, for the purpose of allowing the inner lift to rise and fall thereon. In like manner a third lift may be employed, or more.

Further variations in detail may be made, and modifications of the invention may be effected by attaching the rails to the holders, and placing the rollers around the edge of the tank or well, whereby the entire arrangement is reversed; or combinations of the two methods may be employed. Also the invention may be turned about, so to speak, by affixing the curved rails to a framing placed within the tank but inside the holder; and then attaching the rollers to the inner surface of the holder, instead of to the outer. Also upper framing of the usual or modified form may be employed in conjunction with the mode of construction described. These and other variations—such as the number and form of the spiral guides or rails, the number and form of the rollers or sliding blocks, and also of the radial angled rollers—may be made without departing from the peculiar character of the invention.

The claims for the invention are three in number—viz, "1. The construction of tanks or wells for gasholders, or the outer lift or lifts of such holders when telescopic or both, with helical, spiral, or inclined rails, grooves or recesses built into or attached to the wall or face thereof, with the object of carrying the holder, or one or more lifts thereof, as the case may be, by means of tangential, rollers, sliding-pieces, or mechanical equivalents, attached to the lower ring or curb, or other convenient part of such holder, lift or lifts, for the purpose, and in manner substantially as shown and described. 2. The construction of gasholders, single or telescopic, with tangential or angled radial rollers, or both, or sliding-pieces, or mechanical equivalents, attached to the bottom curb or ring of such holder or one or more lifts thereof, or both, as the case may be, with the object of causing the same to ride and rise and fall upon or within helical, spiral, or inclined rails, recesses or grooves built into, forming part of, or attached to the wall of the tank or well or outer lift or both, for the purpose and in manner substantially as shown and described. 3. The construction and employment, for gas storing purposes, of holders and tanks or wells of the special character substantially as shown and described."

AT the September meeting of the Town Council of Moncton, N. B., only one tender—that of the Moncton Gas Light and Water Company—for supplying light and water to the town was submitted. The Company proposed to supply 50 street hydrants with water at the rate of $50 each per annum, and to maintain 30 arc lights (2,000 candle power, to burn each night and all night), at the rate of $180 each per annum; if 1,200-candle power arcs are preferred, the charge for same was to be $100 each. Another condition of the tender was that both propositions—that is, for light and water—must be accepted, or the proposition as a whole would be withdrawn. The whole matter was referred to the voters of the town, to be settled by formal ballot.

[FIRST PAPER.]

The Guide-Framing of Gasholders—Can it be Dispensed with, Wholly or in Part?

The Controversy carried on in the London Journal Reviewed.

By WILLIAM MOONEY, C.E.

An article with the title "Is Lofty Guide-Framing Necessary for Large Gasholders?" which appeared in the London *Journal of Gas Lighting* for March 29, 1887, has brought out various conflicting opinions from several engineers, and as the article seems to have awakened renewed interest in a popular subject, the controversy has probably not yet ended. In fact, it is probable that the author little knew what interest would be aroused by its publication, and what actual results were to arise from it. At a period in the history of gas lighting when holders were being made larger than ever before, it needed but someone to start the subject to arouse the latent interest which has shown itself in the pages of the *Journal* for nearly a year.

It is proposed in the present article to review the arguments upon the subject, as briefly as possible; and as they all sprang from the publication of the first article above mentioned, a short statement of the position taken by the author will be given.

At the beginning of the article some hints are thrown out which lead to the belief that Mr. Livesey had already taken some steps toward dispensing with the guide-framing, in some three lift holders lately built; but to what extent the writer is silent. Then follows the statement that "during the coming summer (1887) a gasholder at the Rotherhithe works of the South Metropolitan Company will be altered by the addition of a third lift, *without raising the guide-framing to the additional height.*" The writer further adds, "The saving by dispensing with the framing for the additional lift will not, in this instance, be great; but behind it lies the whole problem of the utility and office of guide-framing in general."

He then briefly explains the objects and requirements of guide-framing, as follows: "It is primarily to provide a means of guiding the movable vessel along its vertical path. The first conditions are rigidity and truth of line; both ends must be made as steady as they can be made—to be of any service at all, the guiding structure must not only be rigid, but must preserve its rigidity under the greatest stress that can be brought upon it. According to this theory, every gasholder in England ought to be a wreck before the week is out."

After this startling statement the writer puts forth the following, in all the added weight of italics: "*It is impossible to construct a framework strong enough to uphold a gasholder of any considerable size without depending upon the inherent stability of the holder itself.*" He then continues: "There is in the construction of gasholders a point, depending entirely on their bulk, beyond which these structures are wholly independent of the exterior framing with which it is at present thought necessary to provide them. If this were not true, the erection in the open air of holders surpassing 40 to 50 feet in diameter and 30 to 40 feet high would have been impossible. As soon as the limit had been passed, every gale would have swept the land clear of gasholders—and the larger ones would have been inclosed in storm-proof buildings."

This statement is really saying, in other words, that large holders hold themselves up without aid; or no large holder exists in which the guide-framing is strong enough to resist the pressure of the wind, without the aid of the holder itself.

The writer then goes on to say, in effect, that he believes the only framing necessary for guiding large holders is a framework standing a few feet above the water level in the tank, or, at most, to the height of the inner lift.

As the difference between these two points in a three-lift holder would be great, it is probable that the writer meant to say to the height of the outer lift.

Continuing, he says: "The only good effect of all devices of columns, guides, diagonal ties, and the rest of the usual elaborate guiding structure, is to transmit the strain to the ground as directly as possible. There is no strength in the members in the air; all they are good for is to preserve rigidity of form, and to send their burdens down to earth without getting forced out of shape in so doing."

The writer, after asking the question, "Why employ elaborate and costly independent framing to transmit to earth the sideways pressure of a gasholder, when you have the holder itself to do it?" answers it thus: "In every large holder yet extant stability has proceeded from two facts—dead weight and tight bottom rollers. Without these no outside framing that was ever erected could save a holder from wreck by the first sou'wester. With them, the outer guiding structure becomes of very

minor importance." In conclusion, he says: "At its base, and not at the top, is the place whence the stability of a gasholder must be provided for, if at all."

The first notice of, or reply to, this article comes from Mr. V. Wyatt, who, after disagreeing with the previous writer in some things, finally agrees with him to this extent: "Gasholders can be constructed to work well with the external framework carried up only a short distance—say about 10 feet above the wall coping of the tank; and *perhaps* without any external framing at all. Modifications of the lower curb and the cup, and grip junctions of telescopic gasholders properly spliced, may effect this, but the present form of construction, minus the external framing, will not be enough. I quite anticipate the production of a self-sustaining gasholder in the future."

Mr. H. E. Jones, in a short article commenting on the above ideas, thinks that the drawback of any device dispensing with the guide framing would be to increase the weight of the floating part of the structure, which is heavy enough already.

Mr. G. Livesey, who would naturally be in the foreground in such a controversy as this, is the next to write on the subject.

He thinks that the writer of the original article goes too far and proves too much; that, in fact, he has got slightly beyond his depth, and much stronger proof than the writer gives is needed to show that large gasholders can work wholly independent of exterior framing.

Continuing, he says, "If some practical means could be devised, whereby all the bottom rollers could be made to rise or fall equally, the holder would then, to all intents and purposes, have a solid foundation, and no columns or guide framing of any kind would be necessary.

"As there are no known means for keeping the bottom rollers in the same level plane, we must prevent tilting by means of tiers of rollers, placed a certain vertical distance apart on the sides, working against the guide framing. I am not prepared to say that if only two tiers of rollers are used they should be placed at a less vertical distance apart than at the top and bottom of the outer lift. This will necessitate external guide framing to a corresponding height, and such guide framing is also essential for guiding the inner lift until it is cupped. To expect the inner lift to rise and fall satisfactorily when guided by the rollers on the cup is out of the question; it must have rollers on the crown curb working in the external framing to guide it until it is cupped. When a two-lift holder would no doubt work with perfect safety without further support from the guide-framing, I should, with a three or four-lift holder, consider it necessary to carry the guide framing to the height of two lifts, so that the second might be cupped before the rollers on the crown curb left the guides. In short, a holder cannot be considered perfectly safe unless it has at least two tiers of rollers, at a considerable vertical distance apart, working against perfectly strong guides."

In concluding, he sums up by saying: "The utmost I expect to see is, for a double-lift holder guide framing not less than one lift high, and for a three or four-lift holder guide framing not less than two lifts high; and I much doubt whether anyone will attempt to go beyond this."

The next article from Mr. Chas. Hunt, of Birmingham, contains nothing of importance, and concludes by saying: "If I ventured to express a definite opinion upon so speculative a subject, it would, as regards telescopic holders, be adverse to the proposal of the writer, mainly because it seems to make no adequate provision for the safe working of the inner lift—when this happens to be uncupped. In the absence of any simple and efficient substitute we have to fall back upon external guide framing, at least equal in height to the depth of the lift, for effecting this object."

In the same number of the *Journal* Mr. W. Mann states that a three-lift holder was erected in London, several years ago, by the Phœnix Gas Company, having guide framing only two lifts high. He, however, says he never knew how it worked nor what became of it

Mr. J. Somerville, in the *Journal* of May 26, 1887, supplies the missing facts, stating that he has ascertained that the holder above mentioned was a failure. It was never cupped, and was changed to a double-lift; and, after a few years use, was finally taken down (in 1882) with other holders, presumably to make room for other structures.

The next writer on the subject is Mr. W. H. Y. Webber, whose paper was read at the 24th annual meeting of the Gas Institute, held at Glasgow, in June, 1887.

The writer states: "That the purpose of his paper is to show that the ordinary lofty guide framing of gasholders may be safely dispensed with, and its place supplied by a system of *guiding from the base*, which may be shortly described as a development by a duplication of the bottom curb and rollers."

It is also the writer's idea that the sole provision for guiding and maintaining the stability of a holder will be the rollers on the outer lift working against guides in the tank, and only carried by short piers or brackets to the height of 5 or 6 feet above the water line.

In writing of the uncertainty respecting the value and effect of the stresses to be provided for, Mr. W. says he "has seen holders wrecked that should have been standing to this hour; and knows of holders still standing and doing good service that ought, according to rule, to have been blown down fifty times over. They stand simply because they cannot help it, or because they have never been subjected to such destructive stresses as are supposed to be inevitable for such structures."

The writer then enters into an elaborate calculation in regard to the actual force of the wind on gasholders, prefacing his remarks by stating, "That, in view of experiments and observations by many celebrated engineers on this subject, it will be fair to assume that a pressure of 20 pounds to the square foot is the greatest actual force that wind is likely to exert over the whole side of a gasholder erected anywhere in the United Kingdom"—as regards the difference in pressure in favor of a cylindrical surface over a vertical plane surface, he takes 50 per cent. of the area of vertical cross section as representing the actual equivalent plane exposed to the wind.

Upon the question as to the manner in which the wind pressure is exerted, and how divided between the columns, etc., composing the guide framing, Mr. Webber takes issue with the writer preceding him, claiming that there is no justification whatever for the assumption that wind pressure tends to push a gasholder *bodily along a horizontal plane*, as it is not a stable bulk but an unstable body, and, when pushed against, will *capsize before it will slide*. That is to say, "The wind pressure on a gasholder is an overturning force." Again:

"The reason of this is on account of the center of gravity being so much above the center of the figure. A gasholder being a cylindrical, iron covered vessel, without a bottom, required to float in water, the vessel being in unstable equilibrium, hence it tends to topple over as soon as the two centers cease to be maintained in a vertical line.

"Every holder must be so guided at all possible altitudes that the center of gravity and the axis or center of figure shall be always in a vertical line. If this condition is seriously disturbed swift destruction of holder and framing must ensue."

Continuing, the writer says, "That the steadiness of a gasholder depends far more upon the tightness of the bottom rollers than upon any other conditions.

"It is the custom of good gasholder builders to make the bottom rollers fit the tank guides as tightly as they can be dropped into place. When this is done the proper adjustment of the other rollers will enable a holder to work without a tremor, however gusty the weather. When the bottom rollers bear tightly all around the overturning leverage of the top-heavy holder is constantly exposed by the leverage between the leeward top roller and the windward bottom roller; and as the distance from the latter to the center of gravity is very much greater than the distance from the center to the top roller, its controlling effect is correspondingly greater.

"This demonstration of the part played by leverage, as distinguished from horizontal thrust in the conditions of a holder's stability, concludes the part of the paper which deals with established principles."

In conclusion, and practically suggesting his ideas of improved construction in the matter under consideration, the writer "Would build on the tank wall a series of concrete or brick piers, about 6 feet above the water line, 6 feet by 2 feet 3 inches at the base, and tapering to smaller dimensions above. The strain of the holder is first taken by the tank guides, which are cast iron boxes, 6 in. by 6 in., filled with concrete, and, of course, rigidly secured to the tank walls and piers."

Briefly stated, the plan of Mr. Webber is to secure the holder firmly at the bottom with radial and tangential rollers, placed in two rows, one row secured to the bottom curb and the other to a secondary curb placed about 5 feet above the bottom curb—both curbs to be extra stiff and strong; the idea being that the holder shall be considered as stepped into a socket, and that socket holding the holder with a grip strong enough to withstand the pressure of the wind, and yet loose enough to rise and fall freely. Again, Mr. W. says:

"The question naturally arises whether the holder is strong enough to transmit the strains to the point of support without taking some of the pressure off by means of external framing. To this it may be replied that if the holder is strong enough to withstand the strain at the top of the socket (that is, at the top of the short piers), where it is most severe, it must be able to carry them at other points where they are less.

"So long as the holder preserves its true figure it will transmit exterior strains to the ground as perfectly as would a surrounding frame work; and it must always preserve its figure while the pressure of gas from within is in excess of the wind outside. A wind pressure of 20 pounds

per square foot is only equal to a gas pressure of 38-tenths; so that most holders have an ample margin of internal force."

In the discussion on this paper Mr. Corbet Woodall (London) said: "Although they might not be disposed to adopt Mr. Webber's theories, they would all thank him for having given an admirable paper, and a healthy shock to anything that might be called stereotyped ideas on gasholder guiding and constructing generally.

"Gasholders must, it seemed to him, become different, more costly, and elaborate structures altogether if the scheme were to be adopted with a chance of success.

"He thought the cost of a holder, built on Mr. Webber's plan (that is, stiff enough to stand the strains of wind pressure, with only short columns about 6 feet high, on the principle of a post stepped in a socket), would be very heavy; probably as great as one provided with external framing. In order to make the bottom rings of rollers so rigid as to keep their form and resist the tendency to crush in (on the leeward side), so much metal must be used, in external curbs and otherwise, as would go far to dissipate the outside saving."

Mr. G. Livesey (London) said he was "About to try trebling a double-lift holder without continuing the framing up to the third lift, and considered there was no danger in doing so if tangential and radial rollers were used for the two lower lifts. The upper lift would have its radial roller to guide it until the second lift was cupped, then it would go clear of the framing."

"He could not agree with Mr. Webber's plan, and did not think it safe. He had a feeling that there was some uncertain element in the question, which would bring a gasholder to grief if guided in that way. He did not see how the inner lift was to be guided until it was cupped. He believed that a three-lift holder could be safely guided by framing reaching only to the top of the outer lift, so that, when fully inflated, the stability of the holder would be dependent upon the top and bottom rollers of the third lift, which he really believed would be sufficient to safely support a gasholder properly constructed. It would certainly not be wise for any engineer to make an experiment of this kind unless perfectly certain it would be safe."

Mr. Webber, after the discussion, stated that "he had simply put forward a suggestion which had to be proved. This would dispose of a great deal of the criticism which had been offered."

He further said: "The difference between Mr. Livesey and himself was only one of degree. He fully admitted that in this matter they must proceed by steps."

The next article is by W. Gadd, C.E., of Manchester. Speaking of wind pressure on holders, he says: "Investigations and experiments have led him to the conclusion that *average* wind pressures are about the most misleading facts possible for the guidance of the constructive engineer, as it is the momentary or sudden gusts of wind which do damage to structures, and not the steady winds, even when they were of a very violent character."

Mr. Gadd then suggests a method of guide-framing, which he calls *opposite leverage carried below ground*. This idea, not very clearly described, is an absurdity not worthy to be mentioned.

In the next issue of the *Journal* Mr. Webber returns to the controversy, and becomes somewhat personal in his remarks concerning Mr. Gadd, whom he accuses of never having seen a gasholder built.

Mr. G., in his article, having spoken of counterbalancing, Mr. W. states that "counterbalancing went out when exhausters came in"—a rather wild statement for Mr. W. to make.

In reply to Mr. Webber, Mr. Gadd admits that he has never been engaged in gasholder building, but states that, "nevertheless, he has seen a goodly number, and finds that there are still in use a number of counterbalanced holders."

A new, and very sharp writer, under the *nom de plume* of "Theory and Practice," also enters the lists in this issue, and criticises Mr. Webber for his opinions in regard to tight bottom rollers, which would be absolutely necessary to carry out Mr. W.'s ideas. He insists that gasholder work cannot be so nicely adjusted as to insure perfect fitting contact between rollers and guides, to say nothing of their becoming loose by wear.

On the subject of counterbalancing he also takes Mr. Webber to task. "Scores of gasholders exist," he says, "with counterbalance weights where exhausters are in use." Continuing, he says: "To my mind you do not want to force gas against a much heavier gasholder than is necessary to give the required pressure in the service mains; otherwise you are wasting engine and exhauster power, and increasing wear and tear and expense." And he adds: "If gasholders are constructed to stand the strains his (Mr. Webber's) mode of guiding would put upon them, the gas company's account for steam power would be nearly doubled unless counterbalancing was used. Mr. Webber's 6-ft. guide framing is a monstrosity."

In the *Journal* of Sept. 6 Mr. Webber answers his unknown critic, maintaining his opinion that "holders can be and are made with the bottom rollers nicely adjusted, and with steel pins working in good bearings preventing wear and capable of adjustment." He also insists that counterbalanced holders, although still in use, are obsolete.

"Theory and Practice," as the champion of Mr. Gadd, returns to the charge in the *Journal* of Sept. 13. He reviews Mr. W.'s opinions on subjects that have been gone over before, but adds nothing of importance to the subject under discussion.

Mr. Gadd also criticises Mr. Webber in a letter in this number of the *Journal*. Referring to Mr. W.'s remark that the bottom curb of a gasholder is perfectly rigid, he says: "Nothing is perfectly rigid; not even the great earth itself, which bends and bulges under the varying strains of the moon's attraction and its action on the mobile ocean." Continuing, he says: "At the present moment I am inclined to think it possible to devise a holder, not only without external guide-framing, but dispensing with piers entirely, and having only one row of rollers at the bottom of the ring, yet forming a structure more stable than the one at present in use, although the rollers may be far from tight in practice." (This no doubt refers to Mr. Gadd's system of spiral guide framing, an account of which was given in the American JOURNAL, issue of Sept. 17, 1888.)

In regard to Mr. Webber's statement that counterbalancing was obsolete, Mr. G. D. Malam writes; "An 80-ft. three-lift holder lately built has two of its lifts counterbalanced, and the exhauster has been relieved thereby to the extent of 20 per cent. of unnecessary work."

The next two articles are evidently from the pen of the writer of the original article. From his very lengthy demonstrations on the subject of center of gravity, wind pressure, etc., he draws the following conclusions:

1st. That gasholders cannot work at all without at least two tiers of rollers to each lift, thereby necessitating guide-framing.

2d. That single-lift holders cannot work safely without sufficient depth of guide-framing.

3d. That unless the depth exceeds one-seventh of the diameter much weight of material is necessitated.

4th. That a telescopic gasholder is even worse, unless the guide-framing exceeds one-seventh of the depth, owing to lever power.

5th. Even without wind pressure, or weight of snow, the above is true and much more so with short guide framing.

6th. Under certain conditions gasholders can be constructed without guide framing reaching higher than the height of the outer lift—the conditions being that each lift must be rigid in itself, and unable to distort under the strains induced; that the guide framing must also be rigid and unyielding, and that the holder must be free to rise and fall perfectly level.

7th. The inner lift would not rack out of shape when the vertical stays are strong and well attached to strong curbs and sheeting; but as an additional safeguard, diagonal ties may be introduced between the vertical stays, and so relieve the side sheeting from diagonal strain.

8th. Gasholders can be constructed safely with the inner lift unsupported by external guide framing after it has cupped, providing the guide framing is carried to the height of the two outer lifts.

9th. That it is not safe nor advisable to make triple-lift holders with guide framing to the outer lift only.

In the *Journal* of July 31, 1888, is given an account of the completion of the gasholder at the Rotherhithe station of the South Metropolitan Gas Company, said holder having been changed from a two-lift to a three-lift holder, and erected without guide framing beyond the height of the second section.

Early in the discussion on this subject Mr. Livesey stated his intention of making this experiment. Of course, this practical example and bold innovation of the old-time methods is still in the experimental stage, and has yet to stand the test of the elements.

This holder is 150 feet in diameter, with 25-feet lifts, standing in an iron tank only half sunk in the ground. It will thus be seen that the conditions were not favorable; and if the holder stands and works to the satisfaction of its builder it will be all the more a success for its projector.

The crown of the upper section was heavily trussed, the *Journal* stating that the superfluous metal amounted to 80 tons. The paper also states that the columns were connected at the top and middle by lattice girders, and no mention is made of any change in this respect. This portion of the guide framing, it seems to the writer, will be the first to be dispensed with in the future.

The *Journal* further states that Mr. Livesey expressed himself as per-

fectly satisfied with the result, which practically marks a new era in gasholder construction. The *Journal* concludes as follows: "It shows that monumental structures are not necessarily strong, and that massive doric columns and heavy crown trussing are not enough, by themselves, to constitute a trustworthy holder.

"Regard for right principles is the only fountain of security in gasholder construction, and the most important principle of the art may be briefly summarized in the aphorism: Take care of the bottom, and the top will take care of itself."

The person writing under the *nom de plume* of "Theory and Practice," in the controversy, again comes to the front, in a very clear and concise letter to the *Journal* of Aug. 21st last. Referring to the article on the successful issue of the Rotherhithe experiment, he says: "The writer of the article also infers that because the top lift does not blow over when the top part of the guide framing is done away with, it does not push at the top guides when the framing is carried to the full height, as usual; or, in other words, that the top rollers never have any work to do.

"This shows what false conclusions may be drawn from an experiment improperly understood. In the Rotherhithe holder the total horizontal push of the wind, the resultant horizontal shear, the bending strain at foot of guide framing are all the same as if the guide framing reached the full height. The crippling or buckling strains are increased, because the cups are not so well suited to resist distortion as the top curb is, and, therefore, render but little assistance to the guide framing. The great difference in the conditions is this: The bell of the gasholder itself is now called upon to act as a cantilever in its upper lift, which it is not required to do in the ordinary construction. It would undoubtedly push against the top of the guide framing if there were any to push against; but as there is not, it has to take all the bending strains in itself, caused and created by abolishing the top framing."

(To be continued.)

On the Chemical Processes Involved in the Rusting of Iron.

Prof. A. C. Brown, in presenting this subject at the Edinburgh meeting of the Iron and Steel Institute, disclaimed any idea of describing new facts about the topic under consideration, since he believed that everything connected with it was to be found in the records of chemical research. He then went on to say: As I find, however, that the process involved in the rusting of iron is often misunderstood, and that the known facts have not been put together in their connection, I have thought it might be worth while to do so. My attention was first called to the subject by observing what happens when a drop of rain falls on a clean, bright surface of iron. At first, for a short time, the drop remains clear, and the bright surface of the iron is seen through it; but soon a greenish precipitate forms in the drop, and this rapidly becomes reddish-brown. The brown precipitate does not adhere to the iron, but is suspended in the water, and becomes a loosely adherent coating only when the water has evaporated. I may premise that, in speaking of rusting, I mean the formation of rust on the surface of metallic iron exposed to ordinary atmospheric conditions. I do not intend to treat of the corrosion of iron by substances such as sulphuric or sulphurous acid, hydrochloric acid, or any other occasional impurities which may be present in air. It has been conclusively shown that the necessary conditions of rusting are—(1) metallic iron, (2) liquid water, (3) oxygen, and (4) carbonic acid, both the latter being dissolved in the liquid water. Iron remains quite free from rust in an atmosphere containing oxygen, carbonic acid and water vapor as long as the water vapor does not condense as liquid water on the surface of the iron. Let us consider now the action on iron of the three substances, liquid water, oxygen, carbonic acid, singly, and then two and two. Liquid water, quite free from dissolved gases, does not act on iron at ordinary temperatures. At high temperatures, very rapidly at a red heat, iron is oxidized by water or water vapor, and is converted into the magnetic oxide of iron. This magnetic oxide is formed on the surface of the iron as an adherent coating, and only when it is detached can the water gain access to the lower layers of the iron. Oxygen gas alone does not act at ordinary temperatures on iron. At high temperatures it also converts the iron into the magnetic oxide, which forms an adherent coating. The same is the case with carbonic acid gas, acting alone. At ordinary temperatures it is without action. At high temperatures the carbonic acid is reduced to carbonic oxide, and the iron is oxidized to magnetic oxide, which forms an adherent coating. Liquid water with oxygen dissolved in it does not act at ordinary temperatures on iron. This is shown by the fact that ordinary water exposed to the air does not rust iron if the water contains a substance such as lime, or caustic alkali, capable of combining with carbonic acid and itself without action on iron. As long as the lime or caustic alkali is there no rusting occurs. When the lime or caustic alkali has been converted by the carbonic acid of the air into carbonate, then, and not till then, can the carbonic acid of the air dissolve as such in the water, and then, and not till then, does rusting begin. Water containing carbonic acid dissolved in it acts on iron at ordinary temperatures, forming ferrous carbonate, which dissolves in the carbonic acid water, forming, no doubt, ferrous bicarbonate. In this way artificial chalybeate water has been prepared by shaking up finely-divided iron with carbonic acid water. In this action hydrogen gas is given off. Solutions have been thus prepared containing nearly one-tenth per cent. of iron. If oxygen is present dissolved in the water it will unite with the nascent hydrogen, and if we have sufficient water, iron and carbonic acid, the whole of the dissolved oxygen will be thus consumed. The presence of dissolved oxygen quickens the solution of the iron, the tendency of the oxygen to combine with the nascent hydrogen supplying an additional motive to the action. Probably in ordinary rusting no hydrogen actually becomes free, as under ordinary conditions there will always be enough dissolved oxygen to convert all the nascent hydrogen into water. When a solution of ferrous bicarbonate is exposed to an atmosphere containing neither free oxygen nor carbonic acid it loses carbonic acid, and insoluble ferrous carbonate is precipitated. If free oxygen is present in the atmosphere to which it is exposed the ferrous carbonate is oxidized into ferric hydrate, carbonic acid being given off. This, if the water is not already saturated with carbonic acid, dissolves in the water. We can now follow the whole process of rusting and divide it into stages—these stages being really separable, if we take proper precautions, but in the usual case overlapping one another. We have (1) the formation of soluble ferrous bicarbonate; (2) the conversion of ferrous bicarbonate into ferric hydrate, the white ferrous carbonate passing through green and black intermediate substances into the reddish-brown ferric hydrate—that is, rust. We have to note that the carbonic acid dissolved in the liquid water, which is necessary for the process of rusting, is not used up in the process. It is given off during the oxidation of the ferrous bicarbonate to ferric hydrate, and is thus ready to act on the new surface of the metallic iron. The continuation of the process of rusting is not, therefore, dependent on new carbonic acid absorbed from the air, but the original carbonic acid, if not removed, can carry on the process indefinitely, as long as liquid water is present, and oxygen is supplied from the air. Once the process is started it goes on more rapidly, because the porous rust not only does not protect the iron, but favors, by its hygroscopic character, the condensation of water vapor from the air as liquid water. A piece of iron, therefore, which has begun to rust will continue rusting in an atmosphere not saturated with water vapor, an atmosphere in which a piece of clean iron will not rust, because liquid water will condense on the hygroscopic rust from such an atmosphere, but not on the bright iron.

How to Keep Tools.

A machinist says, anent this subject: Keep your tools handy and in good condition. Every tool should have its exact place and should always be kept there when not in use. Having a chest or any receptacle, with a lot of tools thrown into it promiscuously, is just as bad as putting the notes into an organ without regard to their proper place. If a man wants a wrench, chisel, or hammer, it's somewhere in the box or chest, or somewhere else, and the search begins. Sometimes it is found, perhaps sharp, perhaps dull, may be broken, and by the time it is found he has spent time enough to pay for several tools of the kind wanted.

That habit of throwing every tool down, anyhow, in any way, or any place, is one of the most detestable habits a man can possibly get into. It is only a matter of habit to correct this. Make it an inflexible end of your life to have "A place for everything and everything in its place."

It may take a moment more to lay a tool up carefully after using, but the time is more than equalized when you want to use it again, and so it is time saved. Habits, either good or bad, go a long way in their influence on men's lives, and it is far better to establish and firmly maintain a good habit, even though that habit has no special bearing on the moral character; yet all habits have their influence.

Keeping tools in good order, and ready to use, is as necessary as keeping them in the proper place. To take up a dull saw or dull chisel, and try to do any kind of work with it, is worse than pulling a boat with a broom, and it all comes from just the same source as throwing down tools carelessly—habit. Nothing more nor less. To say you have no time to sharpen is worse than outright lying, for if you have time to use a dull tool, you have time to put it in good order.

Bredel's Sequence of Gas Apparatus.

By Fred. Bredel, C.E.

Up to the present time it has been almost a matter of impossibility completely to (in the ordinary working of a gas plant) free the gas product from tarry contamination; and also under usual circumstances (more particularly, however, in hot weather) great difficulty is experienced in keeping the ammonia content down to the lowest possible limit—this latter annoyance is chargeable to the high temperature of the gas as it passes out of the washer—notwithstanding the use of a great volume of water. Some may have observed that the gas is frequently hotter on emerging from the washer-scrubber than when it entered the same, and this is due in great measure to chemical reaction in the formation of carbonates of ammonia. To remedy this has been my object in the construction and arrangement of the following sequence or combination of apparatus.

In the illustration, Fig. 1 shows a tar and carbonic acid extractor; Fig. 2 represents a condenser; and Fig. 3 is the ammonia washer proper. The method of the passage of the gas from vessels 1 and 2 to 3 is shown in the remaining cut. In the lower compartment of apparatus No. 1, in which the entering gas is at a temperature of from 70° to 75°, all the tar is removed; and in the second compartment a large quantity of carbonic acid, and also some sulphuretted hydrogen, is extracted. As it will be found that the gas on leaving this apparatus is slightly hotter than it was when entering it, it becomes necessary to cool the gas to about 60° or 65°, which operation is effected in the multitubular condenser (Fig. 2). Also, any ammoniacal liquor that may, through the rapidity of the flow of gas leaving apparatus No. 1, be brought mechanically into apparatus No. 2, is here condensed, and flows, through pipes *K* and *H*, in the form of strong ammonia liquor, to the ammonia well. The gas is now properly cooled on entering apparatus No. 3, and having passed through the latter emerges from same perfectly free from ammonia, and with only

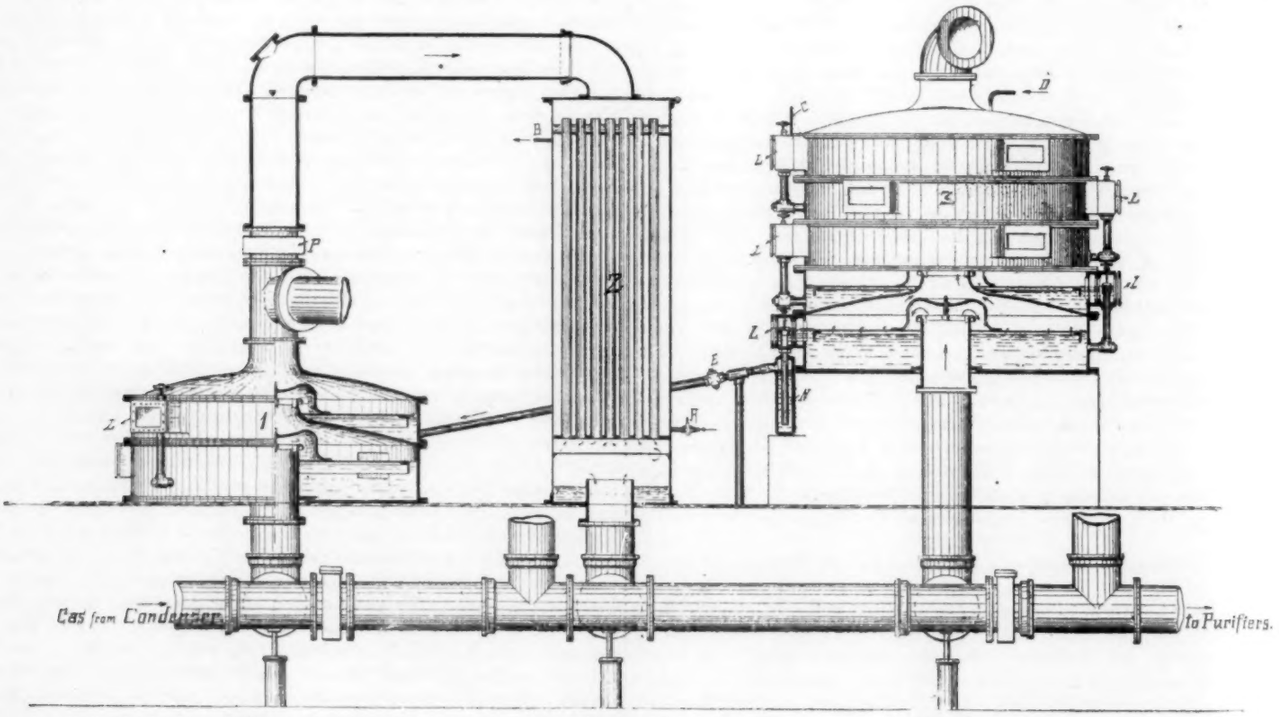


Fig. 1. Fig. 2. Fig. 3.

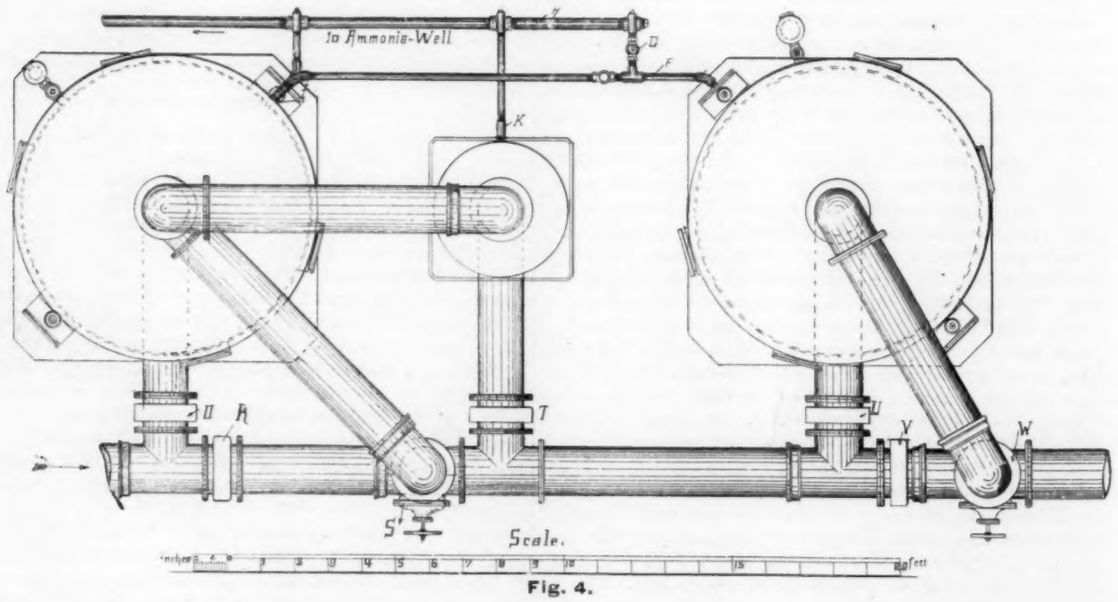


Fig. 4.

from 40 to 50 per cent. of its original content of carbonic acid and sulphuretted hydrogen, which, of course, relieves the purifiers of much heavy work.

The clear water passes in at *D*, in apparatus No. 3, descending from tier to tier, and, mingling with or meeting the ascending gas, passes out in the form of strong ammonia liquor through the siphon *N*. It then leaves apparatus No. 1 in a similar way to that explained in the case of No. 3, and goes on to the ammonia well. The cooling water for apparatus No. 2 enters at *A* and emerges at *B*; the quantity of water supplied is regulated by the temperature of the gas passing out of apparatus No. 3.

A great advantage is secured in the removal of the tar by means of ammoniacal liquor instead of by mechanical condensation, for the formation of naphthaline is thus in great measure prevented—naphthaline is one result of a too rapid condensation, and the taking up of the illuminants of the gas by the heavier tar, if the same remains in the gas after it has been cooled very much, and so on.

If all the ammonia liquor obtained from the hydraulic main and condenser shall be concentrated, only a very small quantity of clear water is admitted in apparatus No. 3 through *D*, the ammonia liquor from main and condenser being pumped into the second or third upper tier; and as this liquor is a weak solution of nearly caustic ammonia, containing but a slight percentage of carbonates, the absorption of carbonic acid and sulphur compounds is then more energetically and thoroughly accomplished.

Dampness in Foundations.

A well-known English architect says that a wall constructed of brick or stone of any quality whatever will be subject to the damp which exists in the soil, and which will enter in all directions and in all parts where the wall is in immediate contact with the ground. The extent to which this damp will penetrate cannot be determined, and it may rise to a very great height above the level of the soil; and if it be arrested more or less, that will be caused by the influence of the neutralizing power of the temperature of the atmosphere; so that a wall which may be very damp at the beginning of summer will be much less so at the end of the dry season, and particularly so if immediately exposed to the sun, but the following winter the damp will return, unless the original causes of humidity be subdued.

It is desirable in all and every class of soil to have a substratum of concrete under the footings. For the purposes of damp this need not be very deep, perhaps not exceeding a foot high. As soon as the footings and lower part of the wall are carried as high as the level of the ground inside, it will be well to introduce a thin sheet of lead the whole thickness of the wall, or a layer of bituminous substance as thin as possible, so as to penetrate the brick and stone and fill the pores, or a double course of thick slate set in cement. The purpose of the sheet of lead and of the bituminous substance and the slating is to prevent the wet from rising up from the footings.

But other precautions are necessary to prevent the access of damp from the surface of the ground next the outside face of the wall. A facing of stone is the best remedy. It need not be very thick, but it is well for it to be at least two or three feet high; and if a small interval between this facing slab and outside surface of the wall, so much the better, provided a circulation of air be kept up in the space. By this provision neither the rain beating against this part of the wall, nor the water returning from the pavement or ground, will be able to reach the main substance of the wall; for although the facing slabs may be temporarily damped, they will soon be dried without communicating the damp to the body of the wall.

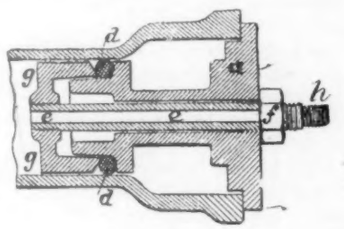
The inside of external walls should never have the plastering applied immediately on the face. They should be battened by means of long narrow slips of wood attached by holdfasts to the inside face of the wall. These slips or battens receive the laths upon which the plastering is applied. The space formed by the battens between the wall and the lathing effectually keeps out the humidity. No impervious covering should be laid on wooden floors in the lowermost story, such as oil cloth for instance; a certain moist air always rises from the ground and escapes through the joints of the boards, but if this be intercepted by an oil cloth the air will rot the boards and oil cloth in a very few months. But it is very important to keep the damp from the floors which come upon the ground—that is, the floors of the lowermost story.

It is evident that the timber of stone slabs should not be in immediate contact with the soil. For this purpose let a stratum of concrete be laid over the whole surface of the house, six or nine inches thick at the least. Upon this form sleeper walls or piers up to the necessary height, and on them lay the plates or paving slabs. As an additional precaution a thin sheet of lead might be laid under each pier on the bed of the sleeper walls. In palaces, as a greater precaution, and in buildings where expense is a secondary object, a thickness of asphalt might be laid on the concrete. In the dwellings of the poor it is expedient, at all events, to have the sleeper walls or piers, which need be only half brick wide and one course high, without the cement, and generally that will be a sufficient precaution. Where stone paving forms the floor bricks must be laid under all the joints. Thus will the humidity be more or less prevented from reaching the floors.

But of all precautions to prevent damp entering by the face of the wall the best remedy is to have an area, which, by keeping the soil at a distance, precludes its fatal effects on the wall. These areas may be three or more feet wide, and may serve as a passage all round the building, and afford access to cellars outside, as in the London houses; or if this, from want of space or the expense, be impracticable, it will be sufficient to have what are called blind areas, with convex walls against the earth, the points of contact with the outer wall of the house being as small as possible to diminish the possibility of the communication of damp.

Plugs for Testing Pipes.

M. Jacob Jooss, of Paris, France, has invented a plug for testing pipes, an illustration of which is given below. Its principle differs in no essential particular from the one followed by other recent inventors in the same line, and depends upon the lateral expansion of an elastic ring produced by compressing it in a direction parallel to the axis of the pipe.



Its use is very simple. A plug having been introduced into each end of the pipe to be tested, the nut *f* of each plug is screwed up, drawing together the head *a* and the follower *g* by the rod *e*, and compressing between them the india-rubber ring *d*, which is thus forced out against the inside of the pipe until sufficient tightness is secured.

One of the plugs has the rod *c* hollow, with a thread at *h*, to which a proving pump can be connected.

The head *a*, it will be noticed, is adapted to fit either the bell or spigot end of the pipe, and the portion of the follower *g* which bears against the ring *d* is inclined so that the tendency of the proving pressure to force the plug out serves to wedge the packing ring more tightly against the inside of the pipe.

The Halsey plug (which is the invention of Messrs. Halsey & Malcolm, Milwaukee, Wis.) is also intended to furnish a convenient method of sealing a pipe in order to subject it to a pressure test, or other purpose.

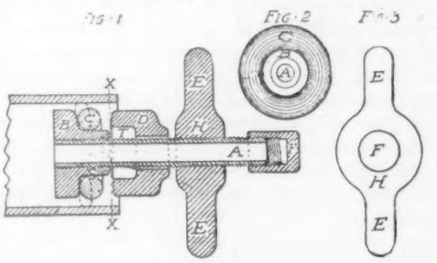


Fig. 1 is a longitudinal section through the center line. Fig. 2 is a cross section through *XX*, and Fig. 3 is an end view. *A* is a piece of pipe threaded for its whole length. *B* is a cast head screwed on to *A*. *C* is a rubber ring fitting on the boss *S* of *B*. *D* is a cast collar loose on *A*, and having a recess *T* to admit *S*. *H* is a cast nut with arms *EE*.

To close a pipe the head *B* is slipped into it, and *H* is screwed up against *D*, forcing it against *C*, which is flattened by compression against the shoulder of *B* and forms a contact with the pipe, as indicated by the dotted lines. A cock or gauge can then be screwed on the outer end of *A*, or it can be closed, as shown by a cap *F*, and the apparatus is ready to receive pressure.

The Supporting Power of Soils.

The following paper, read by Mr. Randell Hunt before the Civil Engineers' Society of St. Paul, Minn., contains many valuable hints for gas engineers:

It is often necessary for the engineer to prescribe a limit of load, per unit of surface, in designing foundations for structures resting upon soil. In the absence of the time and means to make actual tests of the soil, he must confine himself to an investigation of existing successful structures upon a soil as nearly similar to the one under consideration as he can find. It is the object of this paper, then, to present a few remarks upon the actual supporting power of soils as deduced from an investigation of the matter, from our own observations and the recorded examples which have been accessible.

It is probably possible to devise a general mathematical formula which would be applicable to the supporting power of any soil; but as such an expression would necessitate our knowing so many particulars as to the character of the soil—such as its weight and natural slope—that we could judge of its actual strength fully as well without applying it. At any rate, we shall confine ourselves to-night simply to the practical side of the matter.

The Supporting Power of Clay.—The supporting power of clay is very variable, and depends in a large measure upon the variety and its degree of saturation with moisture. In the roadbeds of railroads, when the "surfacing" has been done with clay, a smooth, hard bed, unyielding, and with far greater supporting power than would be required, is always found in dry weather. It becomes very compact, so much so that it is impossible to press the point of a walking cane into it. But after a drenching rain all conditions change, and the roadbed becomes a mass of mud, into which the ties are pressed down, and the clay bulges up between them.

We mention this simple example of dry and wet clay because it is familiar to most of us, and shows clearly the effect of too much moisture in such soils.

The clays vary considerably, however, in their chemical constituents, and are affected thereby in the degree to which they absorb moisture. Certain deposits are known to be compact and hard, with a high supporting power, while others are in the condition of a plastic material, easily compressed. But its chief characteristic, which renders all clay more or less unstable when regarded in the light of a foundation, is its known property of retaining water once admitted to it, and its softening propensities, which gradually take place as the amount of water increases.

The stiff blue clay deposits of London are celebrated as much for the numerous failures of the bridges and other structures founded on it as for any other reason. Old Westminster Bridge had probably about 5½ tons to the square foot of foundation, and failed. Black Friar's Bridge had about 5 tons, and appeared to be stable for many years, but ultimately settled very badly. New London Bridge was built in 1831, and founded upon piles, upon which as much as 80 tons per pile was imposed. Of course, it has settled—in some places as much as a foot. The pressure per square foot of the entire foundation of this bridge is 5 tons. When the new Westminster Bridge was built the load per pile was reduced to about 12 tons, while the load per square foot of the entire foundation was reduced to 2 tons. I find no record of this bridge having shown any signs of settlements.

Robert Stevenson (Trans. Amer. Soc. C. E.) attempted to load a stiff, hard clay with 5 tons per square foot. He was building some high bridge piers at the time, but before they were completed serious settlements took place, and he decreased the amount per foot by making his foundation of greater area than first determined upon. He also built a large chimney which failed, and then constructed another at Newcastle-on-Tyne, with only 1½ tons per square foot of foundation, which was successful. Both these chimneys are described as being founded on hard, compact clay.

The subsoil of the vast valley of the Red River of the North is a bed of clay, which varies in depth from 80 to 125 feet—a bed of sand and gravel usually being found underlying it. This clay is generally of a yellowish color, and appears more or less hard and firm in proportion to the amount of moisture contained in it. Chemically considered, it has a large amount of carbonate of lime in it, as can be seen from its action when treated with acids; and when freshly opened up to view in a place where free from much moisture, appears about of the consistency of marl.

In 1881, at Fargo, Dakota, a brick building four stories in height, including a basement story, was constructed upon a concrete foundation. The pressure per square foot upon the clay was at no place greater than 2½ tons, and was probably even less than this amount. The building showed a certain amount of settlement each season, until the third year after being built one side of it suddenly commenced to crack, and settled a foot a more in a single day, becoming so dangerous that the occupants were compelled to abandon it. The side which failed was immediately torn down, a new foundation of broader dimensions put in, and the wall reconstructed. The load per square foot on the clay of the new wall is about 1½ tons, and, as far as the author knows, has remained intact. All along the side of the wall which failed was an open area-way which was very imperfectly drained, and we are inclined to think this was the cause of the clay becoming softer than it otherwise would have been, for the other three sides of the building, while showing more or less settlement, yet remained comparatively in good condition.

In the city of Cleveland, Ohio, many heavy structures have been founded upon clay deposits, and one or two notable ones have shown serious settlements. In the new Central Viaduct, now being erected, the foundations of which were described in the *Journal of Association of Engineering Societies*, the pressure per square foot of foundation on those piers and abutments which rest directly upon the clay has been limited to from 1 to 1.7 tons. The abutments which exert the largest load mentioned are described as resting upon a "mixture of blue sand and clay, with some water," while the piers, giving a load of but 1 ton per square foot, rest upon "a plastic blue clay of various degrees of stiffness, mixed with fine sand."

When clay is mixed with other materials, as coarse sand and gravel, its supporting power usually largely increases, being greater in proportion as the other materials are in excess, up to the point of forming a concrete mass, in which the clay is the cementing material, and in just sufficient quantity to bind the materials together. In the condition we often find the clay in an indurated state, and the hardness of the mixture—commonly called "hard pan"—is proverbial. Such soils are safe for heavy loads, approximating that of the softer rocks.

Brennecke, in his book on foundations, mentions a large chimney with a load of 6 tons per square foot on hard clay. This is an extraordinary example, and we are inclined to think, though no further particulars are stated, that it was upon some such hard mixture of clay and gravel as mentioned. At any rate it would be a bad precedent to follow in loading beds of pure clay.

The Washington Monument is founded upon a layer of clay and sand. When the shaft was up 150 feet an investigation showed that the foundation was entirely inadequate upon which to complete the structure—a committee of United States Army engineers reporting that such a soil should never be loaded above 10,000 pounds per square foot. The foundation was therefore made heavier and larger, and the shaft successfully completed with a height of 555 feet. Colonel Casey, the engineer in charge, reports the pressure upon the soil as nowhere exceeding 9 tons per square foot, and less than 3 tons per square foot near the outer edges.

The settlement of the monument during the repairs to the old foundations was about 2 inches, and afterward a further settlement gradually occurred during construction of 2 inches more, making a total of 4 inches. If the load per square foot on the soil reaches the amount of 9 tons, it is the heaviest load upon such a soil which we find any record of, and we think the doubts expressed by different persons as to the ultimate stability of the monument entitled to careful consideration.

Supporting Power of Sand.—Foundations on coarse grand and gravel are usually successful, particularly if free from the action of running water, and structures, proportioned in accordance with any ordinary rules of good construction, are hardly likely to have an area of base which will not be sufficient to limit the load per unit to the safe carrying capacity of the soil. Coarse sand deposited in beds has usually a high supporting power, but the coarseness alone is not proof positive of this, for it also depends somewhat upon how it has been deposited. On beds of sand made artificially, as is often done for foundations, the dry sand loosely thrown down does not form a compact mass, such as is desirable, and a certain amount of compressibility will exist.

In some experiments made in France with river sand, it was found that by pounding the sand in thin layers its density could be increased one-fifth, and that there still remained about 20 per cent. of voids which could be notably reduced by simultaneously treating the sand with water, while the stamping down took place. The compression was exercised in these experiments by means of hydraulic presses, and the result obtained that river sand treated as above would resist up to pressures of 1,420 pounds per square inch.

Water is the chief agent which makes the particles separate and draws them into the voids of the mass, and is invaluable in all works of embankment in which solidity is required; but it must also be well

drained off, because if the original amount should remain of course the mass of earth would continue in a semi-fluid state.

Mr. McDonald, in constructing the iron ocean pier at Coney Island (Trans. Am. Soc. E. C., Vol. 8), assumed that the safe load per square foot upon the flanges of the iron disks, which were sunk into the sand, was 5 tons. But many of them really support as much as 6.3 tons continually and are subject to occasional loads of 8 tons per square foot, which they appear to sustain without settlement.

The foundation of the large chimney of the New York Steam Company (Trans. Am. Soc. C. E., Vol. 14) was made of concrete resting directly on the sand of the old beach, which had formerly extended to this point. This sand was quite fine, with pockets of gravel, and containing at a few places some stone. The sand was thoroughly saturated with water, and would flow when disturbed or undermined. The load per square foot on this material was to be 4 tons, but before more than one-third of this amount was placed upon it, slight settlements occurred which were not uniform. After the structure was completed slight cracks appeared, but not sufficient to cause any material damage.

In contrast with loading of the partly unstable sand of this chimney, may be mentioned the loads which were imposed upon a clean, coarse sand in the foundations of the Pacific Mills chimney (Trans. Am. Soc. C. E., Vol. 14), at Lawrence, Mass. Here the sand was inclosed by tight sheet piling, and only 1.83 tons per square foot placed upon it.

The anchorage of the Brooklyn Bridge rests upon sand, with a pressure of about 4 tons per square foot. The Nantes Bridge, constructed in 1863, and founded on sand, has a pressure of 6.78 tons per square foot, but has settled somewhat.

The safe loading upon the sandy soil of Berlin is generally taken at about 2.3 tons. Brennicke describes this sand as being comparatively loose, but likewise mentions its having been succesfully loaded up to 4.1 tons per square foot.

When sand is mixed with other materials, such as clay or loam, which have the power of retaining water, its supporting power grows less, and proportionally more so as the sand becomes finer and loses its sharpness. Of such a nature is the commonly called "quick" sand, which really occupies a position between pure sand and pure clay, being a mixture of them both. Pure clay is composed of alumina, water and silica, and in proportion as the silica is absent the more water will it hold. This is the material which, when mixed with the very fine and rounded grains of sand, makes it "quick." Deposits of such are often found, which through long draining have lost all the water, and which appear dry and loose, and easy to excavate or handle, and generally of a whitish color.

If we could keep such deposits alsolutely free from saturation with water, we could trust it with moderate loads. Its weight is less than either good sand or clay, running from 70 to 90 pounds per cubic foot.

At the foundations of the Capitol at Albany, Mr. W. J. McAlpine describes some of the material as being quicksand without the water. Experiments made in the soil of this foundation showed that under a weight of two tons per foot no perceptible displacement occurred; and at about five tons the surrounding soil was forced upward. It was endeavored to place no more than two tons per foot upon the soil with completed building, and great pains were taken, by means of spreading gravel six inches deep over the whole area and enclosing it in a puddled wall to keep the character of the soil from changing. These foundations have partly failed and serious cracks have appeared in different parts of the structure. We wish here to call your attention to the remarks which we shall make later on, upon judging of the supporting power of soils by limited experiments upon the same. We have not been able to find any complete account of how they were made in this case.

We find recorded by Debauve a case of founding upon a loose, watery sand, partaking somewhat of the nature of quicksand, in which the load per square foot was 1.8 tons. The sand is described as being of a syruppy consistency, and after endeavoring to excavate it without success, further than getting out about three feet in depth, they filled back into this partially excavated hole with dry, coarse sand, placed a bed of beton upon it and completed the structure, which was a bridge over the canal of the Sambre a l'Oise, for the railroad from Busigny to Herson, in France. No after settlement occurred.

This method of treating quicksands with coarser sands and gravel appears to have been of much service in many cases. Trautwine records an example of its successful use in making a foundation over quicksand for the brick aqueduct for supplying Boston with water.

Supporting Power of Soft Soils.—In speaking of soft soils we generally mean those which are referred to as being compressible, though really this is more or less of a misnomer, for they are regarded as being the more compressible in proportion to the amount of water they hold, and yet we know water is practically incompressible. Debauve in his excellent work on foundations, makes this distinction clear, and classes such soils as "*mobile*," movable, which, in itself, is a true definition of their characteristics.

The alluvial mud of many rivers gives us the best example of soils of this kind, and in this country, as in general in most others, the soft soils are usually found at the lower end of rivers flowing through valleys of considerable width and emptying into the sea or large lakes, where the force of their currents is checked by the larger body of water, causing the detritus held in suspension to be deposited in beds of greater or less thickness; or by overflowing their banks and spreading far and wide throughout the valley the waters lose sufficient velocity to carry the suspended matter further.

An example of the greatest magnitude, of such formation, is seen in the country adjacent to the lower Mississippi, and much of the State of Louisiana has been formed in this way. Here is to be found the "*prairie tremblante*," or trembling prairie—vast stretches of land composed of a semi-fluid, mud subsoil, overlaid by a mass of decayed vegetable matter, and which, tied together by rootlets, forms a more solid but trembling crust.

It is impossible, of course, to solidly found anything upon such soil; but rather must any such attempt be regared as a problem of flotation in a muddy liquid. Yet we are often called upon to construct railroads, bridges and buildings in soil but a trifle more solid and homogeneous.

The supporting power of all soils is, of course, dependent more or less upon the depth at which the foundation is made, and in the alluvial soils such as we are now considering this is of more importance than in other kinds. We have not time at our disposal in this paper to enter into this matter more fully, and in our remarks we have treated upon the supporting power of soils as we generally use them and not much affected by depth.

The softer clays really belong to and should be treated in the same manner as the soft alluvial soils to which we are now alluding.

The actual supporting power of such soils can hardly be given in figures which can be of much real value. In the city of New Orleans, for instance, almost without exception, we find recorded the serious settlement of all the larger buildings and structures which have been founded directly upon the alluvial soil, and in many cases the load per square foot is much less than a ton. From some experiments made in India in alluvial soil the safe load per square foot is given as one ton; while Sir Charles Fox (Clemann's Railroad Engineer's Practice) finds it to be only 1,680 pounds for the soil which he tested.

Experiments to determine the weight which can be safely placed upon soft soils have often been made, but are not generally of much value, unless the area of soil tested is of about the same extent as the base of the foundation to be placed upon it. This was very clearly shown in France, some years since, by a series of experiments made in the soft alluvial soil of the valleys of Vilane and l'Oust (Annales des Ponts et Chausees, 1864).

A number of small piers of masonry, 6.56 feet square, were built at different points, and made of such a height as to give a load per square centimeter double that of the large embankment, which it was the intention to afterwards construct. It was supposed that these piers would settle deep into the mud, but they really settled a comparatively small amount, while the embankment, covering a great, broad area of base, but exerting a pressure per square centimeter of only one-half that of the piers, showed in all cases very much greater settlements.

The explanation was simple: if a small pier, with a square base, is pressed down into the soft soil, the frictional resistance against the sides of the compressed ground is proportional to the length of these sides; while a square pier of, say, double the width, would experience a frictional resistance just twice that of the first pier. In other words, this resistance is directly proportionate to the *length* of the perimeters of the bases. But the *area* of the base of the second pier is four times that of the first, hence we see that with an equal pressure per square unit of base, a small pier would have much more resistance to overcome than a large one, and that one would be at fault to take as a correct measurement of the supporting power of the soil the results obtained from loading but a limited area. Experiments upon the soil in New Orleans, made in 1851 and 1852, and which are recorded in *Van Nostrand's Magazine*, Vol. 27, showed analogous results.

Stated, then, as a proposition: *The supporting power of soft soils is greater in proportion as the loaded area is limited*, or conversely

large areas of soft soil will not support as much weight, per unit of surface as more limited areas of the same soil.

This principle is most important, and should not be neglected by engineers designing foundations. It is applicable to the supporting power of bearing piles, and hence any formula for the same which does not make a distinction due to different sectional areas of the piles, is incorrect in theory.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Pittsfield (Mass.) Gas Light Company had a visit from State Inspector Hinman the other day, who, as usual, popped in without any preliminary warning. His guests, however, had no cause for regret, because the Inspector, when taking his departure, informed them that the candle power of their product was equal to 19.5.

SUPT. TRACY, of the Poughkeepsie (N. Y.) Gas Company, is putting in a relief apparatus of the Martin type, similar in capacity (200,000 cu. ft. in 24 hours) to the one installed last July. The new apparatus is being constructed by Mr. J. J. Hurley, of Fishkill Landing, N. Y. Mr. Tracy is very well satisfied with the working of the Martin system.

THE Peoples Electric Company, of Easthampton, Mass., has ordered an arc light plant for street illumination from the Waterhouse Electric and Manufacturing Company, of Hartford.

THE plant and franchises of the Red Wing (Minn.) Electric Light and Power Company have been purchased by the proprietors of the Red Wing Gas Light Company.

THE Sea Isle City Gas, Water and Sewage Company has been incorporated by Messrs. L. W. Wiltbank and G. W. Jones, of Atlantic City, C. W. Matthews, W. G. Hoopes, Nathan Jones and W. R. and C. W. Casen, of Philadelphia. The capital is $100,000, of which sum one per cent. has been paid in.

AT a meeting of the Covington (Ky.) City Council the proprietors of the Covington Gas Light Company submitted a proposition in which they agreed to reduce the price of gas to ordinary consumers to $1.50 per thousand (present rate $2), provided the city agreed to pay $1.25 instead of $1, for the gas consumed in the public lamps. A lively debate followed, in which the promoters of the local electric light company naturally took a prominent part. The matter was postponed for 30 days.

A CHAMBERSBURG (Pa.) correspondent, writing under date of 2d inst., says: "The town is pretty well stirred up over the public lighting question. Some time ago the authorities advertised for bids for lighting the town by electricity, and on Monday of last week all of the bids were, by resolution, rejected; but immediately thereafter a secret bid was presented by one of the former bidders, and his proposition was accepted and ratified in a decidedly brisk and suspicious manner—the fortunate party secured a contract at a much higher price than the one named in his bid that had been rejected. The Council was to sign the contract last night, but in the afternoon they were served with an injunction restraining them from completing the contract. The injunction was issued at the instance of the Chambersburg Gas Company, which had been a competitor in the original contest. The Gas Company's bid was lower than the one accepted, and in the complaint it was charged that certain members of the Council are interested in the contract, and that it was obtained by improper and illegal means. The case will be fought in the courts. The leading ratepayers, strange to say, are on the side of the Gas Company, and the assertion is frequently heard that the scheme will surely be overturned.—PENN."

THE Mutual Gas Company, of Suffolk county, Long Island, has been incorporated. The Directors are returned as M. S. Frost, J. T. Bruen and Geo. Olney. The capital is fixed at $200,000. The right to supply electric light is also included in the franchise. The principal object of the Company is, we believe, to operate in the village of Islip and its immediate vicinity. There is a very fruitful field for a gas company in this locality, which is noted for the number and beauty of its residential structures. To properly pipe the locality, however, will require a comparatively large expenditure. Islip is on the south side of Long Island, and is about 45 miles east-southeast of Brooklyn.

THE Malden (Mass.) Electric Light Company—which supplies light in the towns of Malden, Melrose and Everett—reports the following business: Public lights are distributed and paid for as follows: Malden, 80 arcs and 254 incandescents; Melrose, 26 arcs and 40 incandescents; Everett, 10 arcs and 80 incandescents, the prices paid, being uniform in the places named, are $100 per arc and $18 per incandescent per annum. The total commercial supply includes 600 incandescent and 50 arc lights, $1 each per month being charged for the former and $10 per month for the latter.

A FRENCH observer, writing in *Le Gaz*, declares that bees will not settle on anything flavored with saccharine, and that even the common house fly evinces a decided aversion to liquids sweetened with it.

THE Bloomington (Ills.) *Pantagraph* reports that during the continued agitation of the local electric lighting question an important business transaction between the local gas companies was overlooked. "It will be remembered," says our authority, "that three years ago the then new Gas Company known as the Citizens Gas Light and Heating Company, had swallowed up the corporation known as the Gridley Gas Company. The new Company leased the plant and good-will of the old Company for 20 years, agreeing to pay for the same $10,000 a year for the first 5 years, $12,500 a year for the next 10 years, and $15,000 a year for the last 5 years, making a total of $250,000. The new Company has operated under this lease for 3 years, and has paid $30,000. Prior to the advent of electric light in the city the lease did not seem a bad one for the new Gas Company, but when the latter lost the contract for the city lighting the lease became as an elephant. The latest agreement entered into between the Companies is that by the payment of $55,000 in cash the new Company shall operate the Gridley plant until the old 20-year lease shall have expired."

THE present proprietors of the old Spartanburg (S. C.) Gas Light Company are busily engaged in replacing the antique plant with one thoroughly equipped according to modern ideas.

A RATHER vaporous story comes from Philadelphia to the effect that a Camden plumber was recently intrusted with the task of introducing water to the restaurant of Jno. L. Williams, located at 135 Kaighn avenue, Camden. When everything was supposed to have been performed, Mr. Williams turned on a faucet, and was astonished to find that he had secured an extra supply of gas. It did not take him long to discover that the plumber had found the gas main instead of the water conduit—so the story goes, at least.

THE San Francisco Board of Supervisors have ordered the local gas companies to put up 100 gas lamps at certain specified points in the city.

EARLY this month the St. Louis (Mo.) Gas Trust, at a meeting held in the office of the St. Louis Gas Light Company, elected the following officials: Trustees, Messrs. W. G. Warden and W. W. Gibbs, of Philadelphia, Pa., and John J. O'Fallon, of St. Louis; Secretary and Treasurer, John R. Lionberger. For the vacancy occasioned by the retirement of Mr. Chas. Parsons quite a spirited contest was made, Mr. James Campbell seeking to obtain the place, finally secured by Mr. O'Fallon. Other business transacted at the meeting was the declaration of a $1 per share dividend (quarterly), and the demolition of an elaborate banquet.

JUDGE GARRISON recently ordered, on motion of Samuel H. Grey, a nonsuit in the case of the estate of David Dore against the Camden (N. J.) Gas Light Company, which was argued before the Supreme Court. Some time ago Dore went to the gas works to purchase a load of coke. His horses became frightened at the noise and sight of a great volume of steam and smoke rising from a pile of coke which was being quenched in the ordinary way, and in attempting to quiet his animals Dore was thrown and killed. His widow brought suit to recover damages, but as the evidence showed contributory negligence, the nonsuit was ordered.

THE United States Oil and Gas Stove Company has been chartered in Chicago by Messrs. E. B. Hamlin, H. J. Baker, and J. B. Payne. Capitalized in $100,000.

THE joint special committee of the Bangor (Me.) city government has reported in favor of the project authorizing the city to construct and operate an electric plant for the illumination of the streets, power to be supplied from the water works dam. The investigators estimated that $25,000 would put the city in possession of a plant capable of maintaining 150 arc lights of 2,000-candle power each, and asked for authority to draw up specifications and advertise for bids. Their request was agreed to.

PROF. P. B. WILSON, Inspector of gas and illuminating oils for Baltimore, Md., reports that the illuminating power of the Consolidated

Gas Company's product for the month of September averaged 29.33 candles.

THE following, from the Richmond (Va.) *State*, explains itself: "To the Honorable City Council of the City of Richmond—The undersigned, on behalf of clients who desire to make a proposition looking to the acquisition of the gas plant now owned by the city of Richmond, which, it is believed, will be for the best interests of the citizens and at the same time secure just and adequate compensation to the city, begs that your honorable body will be pleased to give the question due consideration, and respectfully requests that this communication be referred to such committee as your honorable body may deem best, and that I shall be granted a hearing by the committee at an early day. With great respect, I am very truly yours—H. A. ATKINSON, JR." Mr. Atkinson's petition was laid on the table, where it should be permitted to remain.

IT is said there is every likelihood of an increase in the list price of iron pipe.

UNDER date of Oct. 4, Superintendent Jenks, of the Woonsocket (R.I.) Gas Company, writes as follows: "I notice in your issue of Oct. 2 an item relative to the putting in by our Company of a new condensing and scrubbing apparatus. This, indeed, is true, but not in the sense implied in the item. What we are doing is erecting a building and foundations to receive a double set of water gas apparatus—the same now being in course of construction by the United Gas Improvement Company of Philadelphia—and which we expect to have in operation by Dec. 1st of this year. Our holder capacity is totally inadequate during the winter months, when our send-out varies 75,000 cubic feet in 24 hours; and it is on this account that we are thus 'casting an anchor to windward,' as well as to be on deck first with water gas. The electric plant is only a question of a short time." We are obliged to Superintendent Jenks for his letter setting us straight on the improvements in progress at busy Woonsocket, and hope hereafter to hear from him in regard to the establishment of the electric annex.

WE are in receipt of a letter from Mr. John Fullagar, formerly Superintendent to the Cincinnati (O.) Gas Light and Coke Company, which shows that (we are more than pleased to add) he has almost regained his former health and strength. In 1886–7 Mr. Fullagar's physical condition occasioned much alarm to his friends, and he was finally persuaded to take a protracted vacation, embracing among its features a visit to California—the Cincinnati Company granting him a year's leave of absence, with full pay. His visit to the Golden State seems to have accomplished that which it was hoped it would, as will be seen from the following extracts from his letter to us, dated Napa City, Cal.: "During the last eight months I have wandered all over the lower part of this State. I have improved in health; in fact I feel like a new man, or at least as if I were ten years younger than when I came here. Have not yet made up my mind what I shall do, but I am afraid to go East again to reside there permanently. I think this is the finest climate in the country. San Diego can beat the world. No winter, no summer—that is, none of the extremes. The temperature range is from 58° to 75°. I think I shall take an interest in some small gas works, or buy an orange ranch and settle here for good. Having a chance to rebuild two small works, I think I will go on with them for the present, to keep me going. I do not expect to make as much at present as I did East; but health is better than money. I am going South next week or so, and on my return I will write you about gas matters on this coast, which seem to be quite lively just now—at Los Angeles, for instance." In closing, Mr. Fullagar asks to be remembered to all his friends.

THE fraternity will rejoice with us that the President of the American Gas Light Association—Mr. Thomas Turner, of Charleston, S. C.—is fast recovering from the effects of a painful and severe accident that befell him some weeks ago. Mr. Turner's physicians recommended him to try equestrianism for some simple ailment from which he had been suffering, and the accident was nothing more nor less than a fall caused by an unfortunate stumble of the horse that he was riding. It was a narrow escape, and we all have great cause for thankfulness that the result was injury (painful though it was) instead of instant death.

THIS time the Springfield (Mass.) gas works are written up in the columns of the Springfield *Union* (it will perhaps be remembered that some months ago one of the "young men" of the Springfield *Republican* attempted a similar task, and made a rather poor success of it, as was noticed at the time in the JOURNAL), and this description of the property managed by Treasurer Hallett is a very fair one indeed. In recapitulating the history of the Company, the *Union* man informs us that the price per 1,000 in 1865 was $4.50; in 1868, $4; in 1871, $3.50; in 1883, $2.40; in 1886, $2; and the present year, $1.75. In 1851 the quantity of gas sent out was 2,328,000 cu. ft.; in 1870, 32,430,000; in 1880, 47,426,000; and in 1887 there was made 71,878,000 cu. ft.—68,883,000 cu. ft. of which amount was sold, the difference being chargeable to unaccounted-for gas. In 1860 the Company had only 90 street lamps, while now the number of same is 471. Last year 15,600 feet of pipe was laid, bringing the total length of conduit to 195,773 feet. The sum of $1,000 is paid for a year's water supply for steam and gas purposes; 227 tons of cannel and 6,298 tons of caking coal were used in 1887, as also 25,300 gallons of oil; and purification took up 6,953 bushels of lime. The average candle power of the gas in 1887 was 18.29 candles. The maximum producing power of the works (24 hours) is 500,000 cu. ft., and the greatest output in 24 hours was 380,000 cu. ft. About 25 men are employed at and about the works. Mr. Solyman Merrick was the first President of the Company, and those who have held office in the enterprise are men well known in connection with the best interests of Springfield. Mr. Marvin Chapin is now President, and Mr. J. L. Hallett, who was chosen General Manager in 1882, was elected Treasurer in 1887, and is quite likely to succeed himself in that capacity for many years. Teachers, with their pupils from the city of Springfield and the surrounding towns frequently visit the gas works, and the information freely vouchsafed them by the courteous Superintendent of the plant has been of great assistance and interest to the juveniles who are receiving their first instruction in chemistry. In concluding his description the *Union* man says: "The property on the whole is a valuable one, and the condition of the works reflects great credit on those who have them in charge. The art of gas making requires such an extensive plant and a knowledge of such a multitude of elaborate details that one can see it is only after a long, difficult and expensive process that the final result—a well-lighted, a homelike interior—becomes a possibility."

FRED. EGNER reports that the extensions and improvements to the Laclede Company's plant are progressing in a most satisfactory manner. We had no doubt of it, Mr. Superintendent.

PRESIDENT CRESSLER is keeping right along with the procession in the matter of enabling the Kerr Murray Manufacturing Company to keep its men on full time. The Company's present contracts underway include the following: For the Ashtabula (O.) Gas Light Company, a complete new 6-inch gas works, comprising retort house roof, horizontal boiler, benches of 3's, rotary exhauster, coil-pipe condenser, tower washer, 6 ft. by 6 ft. purifying boxes, 48 in. by 48 in. station meter, Connelly street main governor, and single-lift gasholder, 60 ft. in diameter by 18 ft. deep. For the Jackson (Mich.) National Gas Light and Fuel Company, one 12-horse power engine, and two 40-horse power vertical boilers, iron floor for retort house, two benches of 6's, two cupolas (9 ft. diameter by 12 ft. in height), 12-in. Kerr Murray improved steam-jet exhauster, multitubular condenser (36 in. in diameter by 24 ft. high), and one set of purifiers, 8 ft. by 10 ft. The connections throughout the works are 12 inches in diameter. For the Eureka (Cal.) Gas Company, one single-lift holder, 50 ft. in diameter by 21 ft. deep. For the Fort Wayne (Ind.) Gas Light Company, four benches of 6's, with self-sealing mouthpieces, anti-sealing bridge and dip-pipes, and diaphragm hydraulic mains. Quite a goodly list.

WHAT a correspondent styles a "very windy argument" was indulged in during a recent session of the Wilmington (Del.) City Council, the occasion that gave rise to the gale being the bids submitted, for the lighting of the public buildings of the city, respectively by the Wilmington Coal Gas Light Company, and the Wilmington City Electric Company. The former bid $775, agreeing to furnish everything to put and keep the lights in good condition, and guaranteeing a 20-candle light with a 5 ft. burner, and accompanied its bid with its own bond for the faithful performance of the contract. The electricians offered to do the work for $830.10, this to include all lamps, wiring, renewals, etc.—the contract to last for one year. The President of the Council (Mr. Farra) was about to ask for an explanation from the City Solicitor, when Mr. Dillin objected on the ground that the Gas Company's bid was not in accordance with the law, and was, therefore, void. Here ensued a long and apparently senseless wrangle, which included many motions and counter-motions. Finally City Solicitor Ball (his voice is somewhat weaker than that of the average Wilmington Councillor) was allowed a chance to say that a Director of the Gas Company asked him if the Company could offer its own bond as its surety, and he replied in the affirmative, and further stated that the bid was a *bona fide* one which the Council could unhesitatingly accept. Mr. McKenna moved to postpone action, but it was not seconded, and Mr. M. Moore thereupon moved to refer the bids to the Com-

mittee on Public Buildings. Mr. Dillin, who seemed very anxious that the electric light company should have the contract, moved that it be so awarded. Mr. Sharkey moved as a substitute that the contract be awarded to the Gas Company, which was voted down, and Mr. Dillin's anxiety was relieved when the electricians walked off with the plum. Although it is not an exeessively large plum, the advertising thus gained seems to be what the electricians were eager to secure.

A DESPATCH from Springfield (O.) states that the business portion of the city was in darkness on the night of the 4th inst., owing to the fact that the electric lights did not shine, a state of affairs brought about by the action of the Council because the Tax Commissioner failed to provide a sufficient levy. General Bushnell, President of the Springfield Gas Light Company, came to the rescue, however, and ordered the gas lamps to be lighted, the same to be kept on until the next meeting of the Council. More evidence of the grasping greed of gas companies is thus written down.

COUNCILMAN Meyer, of the Lincoln (Neb.) Council, has introduced a local ordinance, specifying the price to be charged for illuminating gas, providing for testing and inspecting meters, and creating the office of gas inspector, besides defining his duties and fixing his compensation, to his colleagues. It was read once and then referred to the proper committee.

A HINT from Columbus, Ind., is to the effect that that city is becoming famous for the extravagance of her Council. In addition to purchasing a water works plant and an electric fire alarm system—both praiseworthy investments—the Fathers were contemplating the acquirement of an electric light plant, and had even ventured so far in the matter as to advertise for bids, when the City Attorney raised his voice and made a statement to the effect that the city's indebtedness amounts to 2 per cent. of her taxable property. This admonition had the effect of stopping all proceedings connected with the suggested purchase.

MANAGER STOCUM writes us that at the annual meeting of the Tonawanda (N. Y.) Gas Light Company the following officers were reelected: C. Schwinger, A. H. Crown, J. H. DeGraff, A. C. Campbell, R. A. Stranahan, P. S. Humphrey, and A. G. Kent, Directors. President, J. H DeGraff; Vice-President, C. Schwinger; Secretary, A. H. Crown; Treasurer, P. S. Humphrey. The officers then appointed H. M. Stocum Manager, and named T. Hunt as Superintendent. Mr. S. adds: "The affairs of the Company are prosperous, and its list of consumers grows larger." The new blood infused into this enterprise two or three years ago has evidently not remained in a sluggish state.

TWENTY-TWO shares of the Lynn (Mass.) Gas Light Company were recently sold at auction in Boston at the rate of $136.50 per share. This is the sort of proof that no one can sneer at, for Eastern investors are particularly cautious and conservative.

MR. H. M. LANE, Manager of the Leominster (Mass.) Gas Company, has notified the residents that from and after the 1st inst. the price of gas (oil gas, 28-candle power) in that town will be $4 per thousand cubic feet, with special rates to large consumers. He also says that a further reduction will be made as soon as an increased consumption shall justify such a step. In 1886–7 the average price paid for gas in Leominster was $5.06 per thousand, the total output for that twelvemonth having been 1,546,732 cu. ft. While we are pleased to note this evidence of progress in Leominster, and congratulate Manager Lane on the appropriateness of his business methods in general, we nevertheless must take exception to one statement put forward with great positiveness in his circular to the people of his town. He says, "The quality of the gas will not be reduced, as is often done when the price is reduced." This, to put it mildly, is saying in effect that gas men are inclined to the practice of robbing Peter to pay Paul; but we have yet to hear of a single instance which corroborates the Leominster man's theory. To go a trifle further into the matter, perhaps an 18-candle gas, at $2 per thousand, would better suit the taste and purse of the average Leominsterite than the present 28-candle article, at even the $4 rate—and Manager Lane might find not only ease but profit also in the making of the change.

THE incorporation of a new gas Company for Rutland, Vt., is again being agitated. Why the people in that section of Vermont are so anxious for a policy that is sure in the long run to increase the cost of their artificial light is more than strange; but as this possible duplication of gas companies is often broached in Rutland, it is quite likely that nothing will come out of the current whisperings.

THE supply of gas and electricity in Athol, Mass., is virtually no longer in differing hands. If our information is correct, the electricians are the ones who acted as the absorbers. The amalgamation was precipitated by a petition to the Selectmen of the town which sought to give an electric franchise to the gas company.

JAMES MCGINNIS, of Memphis, Tenn., was fatally shocked by electricity on the night of Sept. 23. A correspondent sends the following particulars concerning the accident: "The circumstances attending this man's death were little short of horrible. He and two other young men left their boarding house with the intention of going to the C. & O. depot to bid good-bye to some friends who were about to leave town. As the two reached the narrow plank walk leading down Front street to the Chesapeake and Ohio Railroad yard, one of them (named Brennan) tripped over some obstacle and fell heavily to the ground. Before either Arndt (McGinnis's other companion) or McGinnis could aid Brennan, the former was also thrown to the ground, whereupon Arndt noticed a wire lying along the ground, which had tripped his companions. As McGinnis did not seem able to rise, Arndt extended both hands to him, which the prostrate man seized, and Arndt experienced an electric shock. The latter tried to break the contact, but the current caused his efforts to be of no avail. In a few seconds McGinnis's grasp relaxed, and Arndt once again fell to the ground. By this time Brennan had staggered to his feet, and both he and Arndt, who had also recovered his footing, rushed anew to the aid of their prostrate companion, but the latter was dead. The only mark on the person of deceased was a black scar on the back of the neck, where the wire had literally crisped the flesh. The coroner's jury that investigated the case reported that deceased met his death from contact with a live fallen wire of the electric light company, which was down through the neglect and criminal carelessness of said company. Much indignation was caused by this lamentable affair, and the officers of the company have been placed under bonds (in the sum of $5,000) for trial."

THE authorities of Chattanooga (Tenn.) have notified the Gas Company, as well as others who are occasionally called upon to disturb the pavements of the streets in the performance of their business, to at once make the necessary changes in their mains, service pipes, etc., in certain specified streets of the city which it has been determined to repave. A failure to do so within the period laid down will debar the offenders from tearing up the named pavements for a period of 5 years, unless granted special privilege for so doing by the Mayor and Board of Aldermen.

AT a meeting of the Galveston (Texas) City Council Alderman Fordtran (having called attention to the fact that the city's gas and electric lighting contracts would expire in April and May, 1889) asserted that as the present contracting companies had been amalgamated, the city would have to pay a high price for future public lighting unless the matter of permitting the establishment of a competing company was at once considered. Ald. McDonald thought the city ought to now advertise for bids for lighting, for a period of three years, which would grant ample time for new-comers to take hold of the work. Ald. Ullman suggested a 5-year contract. Others of the Aldermen took part in the discussion, and when their various ideas had been thoroughly expounded Ald. McDonald moved the appointment of a special committee to consider and investigate the feasibility of the city's engaging in the electric lighting business on its own account. This was agreed to, and Aldermen Reymershoffer, Fordtran and McDonald and Auditor Selkirk were appointed to conduct the investigation.

LATE last month a violent explosion of gas occurred in the new Occidental Hotel, Seattle, Wash. Ter. For some days the smell of gas had prevailed about the building, and the proprietor determined to find out the defective spot. He did so beyond a doubt—aided, of course, by a small lucifer match—and with great *eclat*. Where the odor was strongest seemed to him to be a most appropriate point to affect his coup. The match was ignited and the gas found the flame, or the flame found the gas. At any rate the plate glass windows hurried out to the sidewalk, and the plastering nestled on the floor. When the damage was counted proprietor Collins found that his method of finding a gas leak had cost him something like $1,000 in money, not to say anything of ravages made in his whiskers. If you want to find a gas leak always carry a naked light with you. It is an infallible plan—but somewhat dangerous.

THE annual election for Trustees to serve for three years in the management of the Pittsburgh (Pa.) Gas Company resulted in the selection of Dr. David Hostetter, H. DuPuy, and A. C. Drave.

THE authorities of Jamestown (N. Y.) are considering the subject of installing a municipal electric lighting plant for the purpose of lighting the streets.

THE East Portland (Oregon) Lighting Company has offered to contract with the city to furnish not less than 24 arc lights (2,000-candle power), to be placed at such points as the city may direct, the same to be supplied at the rate of $15 each per month.

IT is said that the famous Amoskeag mill (Manchester, N. H.) has about as varied a lighting service as any other establishment in the United States, to wit: 21 American, 45 Thomson-Houston, 210 Weston and 375 Brush arcs are used in the large spaces, while the looms, spindles and other machinery are lighted by 235 Edison and 75 Forsythe incandescent bulbs.

Estimating the Cost of Lighting Montreal by Electricity.

The Light Committee of the Montreal (Can.) City council have been considering the subject of lighting the city by means of a municipal electric plant, and at a recent session Mr. Badger submitted the following estimate of the probable cost of the seheme:

According to instructions received, I have investigated the matter of lighting the streets of the city entirely by electricity, and estimate it will require 650 arc and 500 incandescent lamps to light the city properly; the arc lamps of 2,000 nominal candle power, and the incandescent lamps of 32 candle power. I have also considered the subject with reference to the establishment of electrical plant by your department, to be owned and run by the city as a matter of economy, and the appended estimates will indicate how much may be saved to the city thereby.

These estimates contemplate a system of 1,200 arc lights' capacity, as far as the building and the plant therein are concerned, and to erect and run at present 800 arc lamps only, or a certain number of incandescent lamps, as may be required for proper distribution of light; and provision is made therein for any future extension of light to 1,200 or 1,300, as may be required to keep pace with the growth of the city.

In order to give the utmost reliability of such a system, the estimates provide for two stations, one in the east and one in the west end, and these stations to be of 600 arc light capacity, each arranged to run independently, and provided with the most complete machinery and apparatus.

In addition to the saving involved, another advantage incidental to the city owning and operatiug the electric lighting system will be more perfect control and facility of extension to meet all requirements.

Estimates.

For electric lighting plant of a capacity of 1,200 lights, arranged in two separate stations of a capacity of 600 each, together with the yearly cost of running the same to furnish 800 arc lamps or equivalent:

Steam plant, including the necessary buildings and ground for two separate stations, with boilers, engines, and shafting for 600 H.P. in each station complete	$145,600
Generating plant for two stations, with capacity for 600 lights each, complete for operation	62,000
Outside plant, including lamps, lines, and construction, with all necessary apparatus, the whole complete for running 800 lights	71,525
	$279,125

Running Expenses.

For 800 arc lights, with two separate stations, steam and electric plant; cost of running per year, including coal, oil and waste, wages, etc.	$23,888
Outside lines and apparatus; cost of running per year, including wages, repairs, carbons, globes for lamps, etc	39,080
Interest on the cost of construction—$280,000 at 4 cent	11,200
Wear and tear on buildings, machinery, and apparatus	8,848
Insurance on buildings and contents	4,075
Total running expenses	$87,091

Cost per lamp per night, 29 7/10 cents.

Mr. Badger based his calculations on the displacement of 4 gas lamps by 1 arc.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Letter from Mr. A. L. Allen.

POUGHKEEPSIE, N. Y., Oct. 8, 1888.

To the Editor AMERICAN GAS LIGHT JOURNAL:

As another annual meeting of the American Gas Light Association is about to take place, and as the subject of illuminating gas in its various phases will be considered, and no doubt that "dreadfully poisonous and dangerous gas," as some have been pleased to call carbonic oxide, will be, as usual, more or less discussed, I desire, through your valuable JOURNAL, to call the attention of the gas fraternity to a few important facts.

First.—Dr. Ozanam, M. G. Tourdes, Leblanc and Devergie (all famous authorities), have safely used carbonic oxide as an anæsthetic upon men and the lower animals. Dr. Ozanam says: "The twenty-five experiments which he made, and several of which have been repeated upon the same animals, show that the use of this gas is not as dangerous as was formerly believed, since we have but one case of death among many animals so delicate as rabbits." M. G. Tourdes says: "The two fundamental facts are the harmlessness of the gas used and its anæsthetic action."

Second.—We have made water gas here over 12 years, and at Rondoubt and Kingston over 7 years past, under the Allen Harris original system of uniform, high, external heats, and continuous production of gas, and people have been, from time to time, exceptionally exposed to its effects, without a single case of death, or even one day of serious illness.

Third.—The subject of the units of heat produced by the different gases has been, from time to time, presented to the Association, and, so far as I can understand, carbonic oxide has always come out second best, to say the least; but standard authorities show that hydrogen and carbonic oxide produce the highest calorific intensity of any of the gases. We have, therefore, believed, and so stated, that these two gases helped to form the best basis or substratum for illuminating gas, producing strong combustion and a white light. This subject of heat has been practically demonstrated by G. W. Harris. His gas works are situated at Rondoubt, N.Y., and his gas mains pass over quite a high hill, and down to Kingston in the valley beyond. He supplies Rondout with water gas, but, as it is too heavy to send over the hill to Kingston, he, therefore, fills his holder at Kingston with coal gas. He has many gas stoves in use in Rondout, and it sometimes happens that he has to make coal gas in the forenoon. Then those who cook by gas will salute him with, "What was the matter with the gas? We could not get up the usual heat in the stove. It took us a half hour longer to cook dinner, etc." These persons knew nothing about his making water gas or coal gas; but Mr. Harris said that they would invariably tell by their stoves the difference between the two gases for cooking—that is to say, between coal gas and pure water gas made under the Allen-Harris process, containing no nitrogen—which is as objectionable in gas as slate is in coal.

Fourth.—Carbonic oxide has been considered a non-illuminant, the same as hydrogen and marsh gas; but Professor Bunsen, the standard authority on gas, has shown, by many experiments, that carbonic oxide will, under certain circumstances, without the presence of carbon, become intensely luminous. This, I think, adds greatly to its value as an element in, or basis of, illuminating gas.

Fifth.—But there are valid objections to the use of water gas alone, among which may be mentioned that it is harsh and rough on meters, and is too heavy for economical delivery through long lines of level or descending grades of mains. We have, therefore, advocated for several years past the mixture of coal gas and water gas, not merely in the holder or pipes, but a chemical combination of the gases during the process of manufacturing—as shown by the Allen-Harris improved process, by which a greatly increased yield per ton of coal carbonized, of medium density and higher candle power, may be obtained than has heretofore been produced. Our late circular gives facts and figures upon these points which cannot be controverted. I am glad to see that coal gas men of experience and energy favor a mixture of coal and water gas, and when these take hold of the subject there need be no fear of the result.

Yours, etc., A. L. ALLEN.

SEVERAL of the residents of the "Island"—a summering spot close to Toronto, Canada—want the Gas Company to extend its mains to their locality.

THE AMERICAN GAS LIGHT JOURNAL

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TUESDAY, OCT. 16, 1888.

The Market for Gas Securities.

The city gas share market has kept pace during the fortnight with the ordinary ups and downs of the market for railway securities, the course of the trading being marked by much raggedness. To-day (Oct. 13) Consolidated is at 81½, or something like 1½ points below the price reported in our last. The bulk of the business, which was in reality of rather small volume, was effected at generally higher rates than 81½, and the stock responded sharply to any improvement, however slight, manifested between times in the regular list. The approach of dividend time brings with it the usual crop of rumors, but it is unknown to any outside of the management whether an increase in the return is to be made. Putting one rumor against another, and allowing for the vapor contained in all of the whisperings, it seems barely possible that the dividend rate will be slightly increased. Equitable is very strong, and holders are satisfied with the outlook. Some of the more confident predict that these shares will readily command 130 before the first of the year. Mutual also holds the summer advance, and we think it is a cheap stock at the ruling figure—99 bid, offered at 101. We doubt very much whether an offer of par would cause a sale—certainly no considerable amount could be obtained at that figure. The Standard Company's shares are seemingly not in great demand.

In Brooklyn shares some animation is noted, and those who followed our advice of last summer have no reason for complaint. Nassau is quoted at 108, old Brooklyn is at 106, Metropolitan at 83, Williamsburg at 125, Fulton Municipal 134, Citizens, 52, and Peoples 75—in each case the bid figure is reported. Despite the advance thus noted, we think anything on the list is yet a purchase. In the miscellaneous list we note continued activity in Eastern shares. The trading, of course, is confined to small lots, for those who hold New England gas stocks evidently appreciate their real value. The Boston situation remains unchanged, although interested parties say that the English capitalists are inclined to seriously consider the proposition made by the Bay State Company's controllers. Chicago Trusts are stronger; last quotation, 34¾ to 35½.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,
16 WALL ST., NEW YORK CITY.

OCTOBER 16.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	81½	—
Central	440,000	50	—	60
" Scrip	220,000	—	47	57
Equitable	4,000,000	100	120	—
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	115	118
Mutual	3,500,000	100	99	101
" Bonds	1,500,000	1000	101	103
Municipal, Bonds	750,000		—	—
Northern	125,000	50	30	—
" Scrip	108,000			
Yonkers		50	90	100
Richmond Co., S. I.	300,000	50	55	60
" Bonds	12,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	106	108
Citizens	1,200,000	20	52	55
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	134	136
" Bonds	300,000		—	106
Peoples	1,000,000	10	73	75
" Bonds (5's)	368,000	—	97	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	83	85
Nassau	1,000,000	25	108	—
" Ctfs	700,000	1000	98	100
Williamsburgh	1,000,000	50	125	126
" Bonds	1,000,000	—	111	112
Out of Town Gas Companies.				
Boston (Mass.) Gas Co	2,500,000	500	200	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	—	—
" " Bonds	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	34¾	35½
Cincinnati G. & C. Co.	6,000,000	100	179	180
Consumers Toronto	1,000,000	50	192	—
Central, S. F., Cal.			—	90
Capital, Sacramento, Cal.			58	—
Consolidated, Balt.	11,000,000	100	51¾	52
" Bonds	6,400,000		107	107½
Hartford, Conn	750,000	25	—	138
Jersey City	750,000	20	165	170
Laclede, St. Louis, Mo.	2,000,000	100	115	117
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	207	—
Memphis (Tenn.) Gas	750,000	100	48	51
" Bonds.	240,000	100	103	—
New Haven, Conn		25	193	197
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Peoples, Jersey City			—	60	61
" " Bonds				—	—

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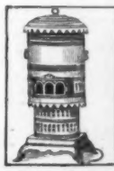

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1 " 3's, Palatka, Fla.
4 " 5's, Fitchburg, Mass.
2 " 5's, North Adams, Mass.
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2 " 3's, Cambridge, Md.

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For Oil Gas,

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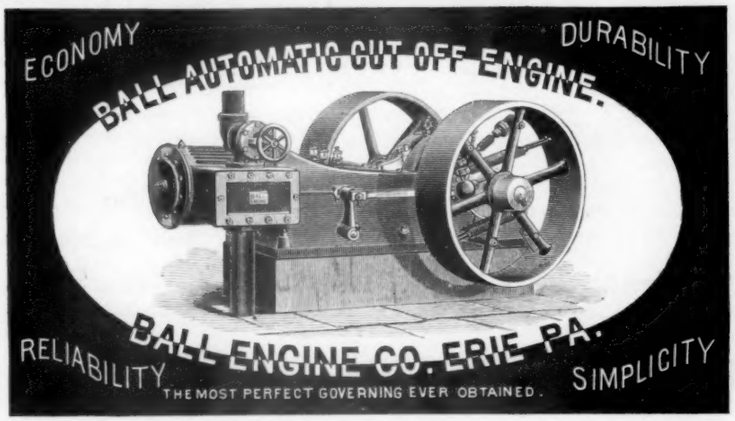

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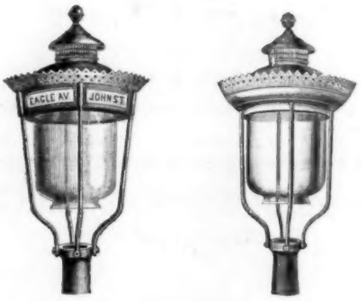

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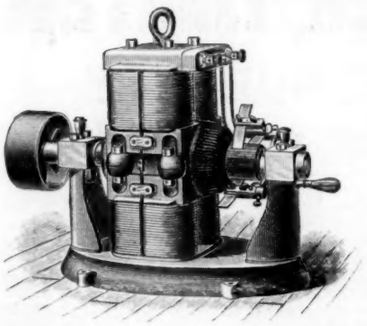

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Varies the Electromotive Force from the Dynamo directly with the Resistance on the Lamp or Motor Line. The Quickest in Action and Most Perfect Regulator in the World.

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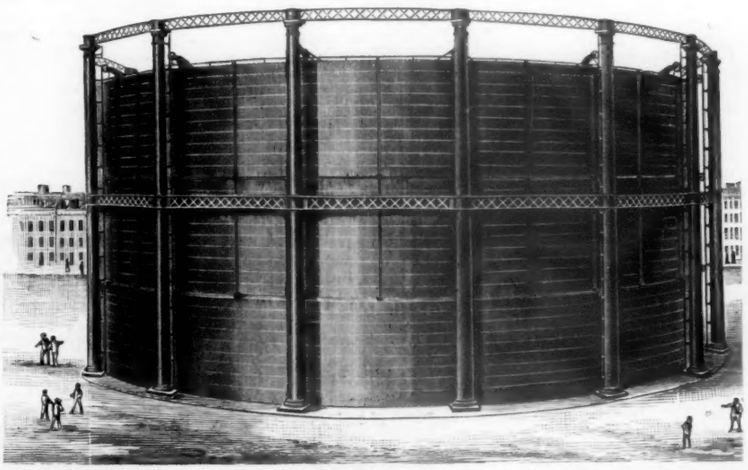

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KIRKHAM, HULETT & CHANDLER, LIMITED.

PATENT "STANDARD" WASHER-SCRUBBERS

Erected and in course of construction at present date:

	Capacity. Cubic feet per day.
Altrincham	600,000
Adelaide	600,000
Aldershot	200,000
Allegheny, U. S. A.	1,000,000
Ashton-under-Lyne	1,250,000
Amsterdam	1,500,000
"	1,500,000
Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U.S.A.	1,000,000
"	1,000,000
"	1,000,000
Balmain, N.S.W	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Burntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
Burton-on-Trent	1,500,000
Barcelona	350,000
Barking	100,000
Baerlien & Co	20,000
"	20,000
Bombay	400,000
Buffalo, U.S.A., Mutual	750,000
" **Citizen**	500,000
Brookline, U.S.A.	500,000
Bergen	350,000
Berlin	1,250,000
Bournemouth	1,000,000
Bridgeport, U.S.A.	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U.S.A.	1,000,000
"	1,000,000
" **Nassau**	1,000,000
Brunner, Mond & Co.	400,000
Cheltenham	2,000,000
Cannes	200,000
Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A.	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000

	Capacity. Cubic feet per day.
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A.	350,000
Denver, "	500,000
" "	1,000,000
Dusseldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z	400,000
Darlington	1,250,000
Detroit, U.S.A.	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W	100,000
Grieg	300,000
Georgetown, U.S.A.	250,000
Gluckauf	200,000
Heywood	600,000
Holywood	125,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwicke	500,000
Haverfordwest	100,000
Halifax, N.S.	350,000
Hamm	200,000
Halle	400,000
Heidelberg	300,000
Hartford, U.S.A.	1,000,000
Ilkeston	300,000
Inverness	250,000
Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kidderminster	750,000
Kidsgrove	100,000
Konigberg	1,000,000
King's Lynn	300,000

LONDON:—

The Gaslight and Coke Co.:	
Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

LONDON—*Continued.*	Capacity. Cubic feet per day.
Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	500,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A.	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A.	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W.	100,000
Minneapolis, U. S. A.	750,000
Magdeburg	300,000
Memphis, U. S. A.	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A.	430,000
Newmarket	150,000
Newark, U.S.A.	680,000
Northfleet	200,000
New York, U.S.A.	2,000,000
Nice	600,000
Newcastle, N. S. W.	200,000
Numea, "	100,000
Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000

	Capacity. Cubic feet per day.
Ober Schlesian	1,500,000
Otto & Co.'s Coke Works	1,500,000
Plymouth	2,000,000
Parramatta, N. S. W.	100,000
Prescott	150,000
Providence, U.S.A.	750,000
"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,500,000
"	2,500,000
Pittsburgh, U.S.A.	1,500,000
Portland, "	560,000
Pawtucket, "	500,000
Quebec	250,000
Radcliffe	750,000
Rouen	250,000
Ramsgate	1,000,000
Reigate	200,000
Richmond, U.S.A.	250,000
Roxbury, "	500,000
Runcorn Soap Co.	20,000
Rockhampton, N. S. W.	125,000
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"	1,750,000
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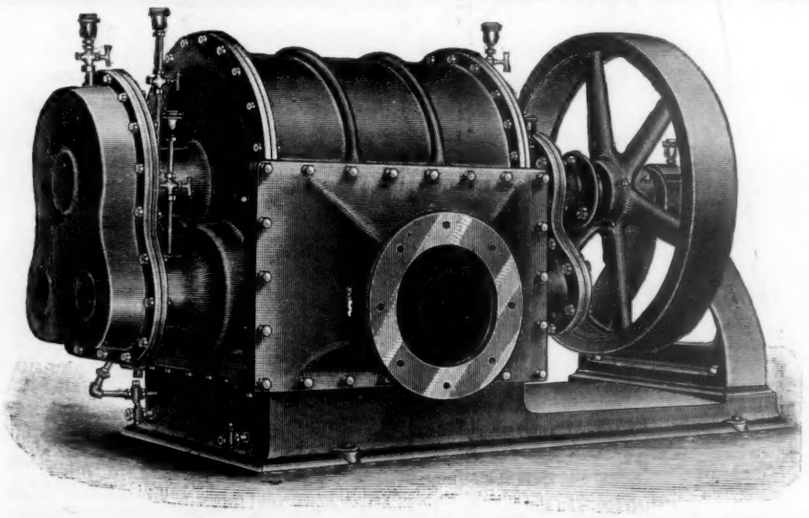

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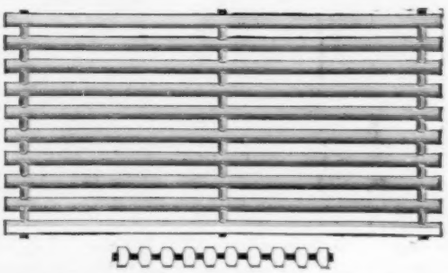

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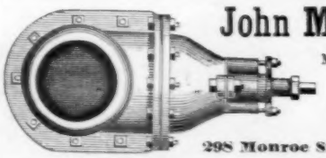

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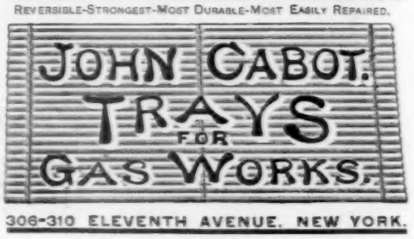

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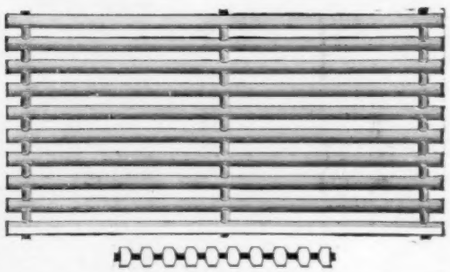

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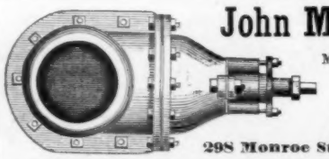

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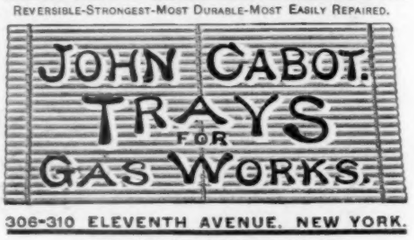

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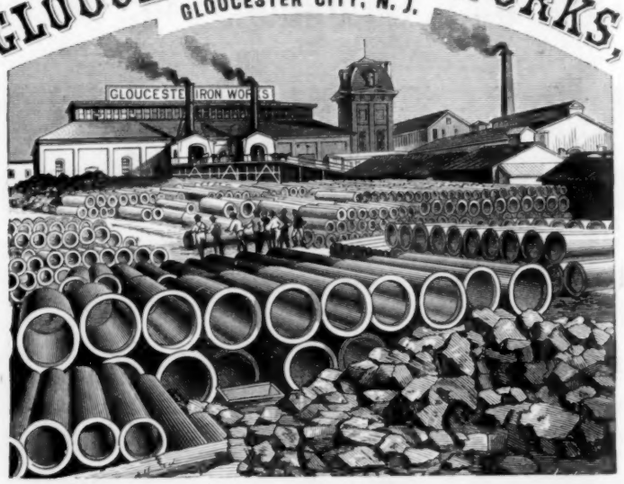

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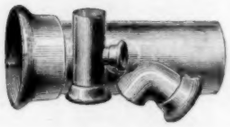

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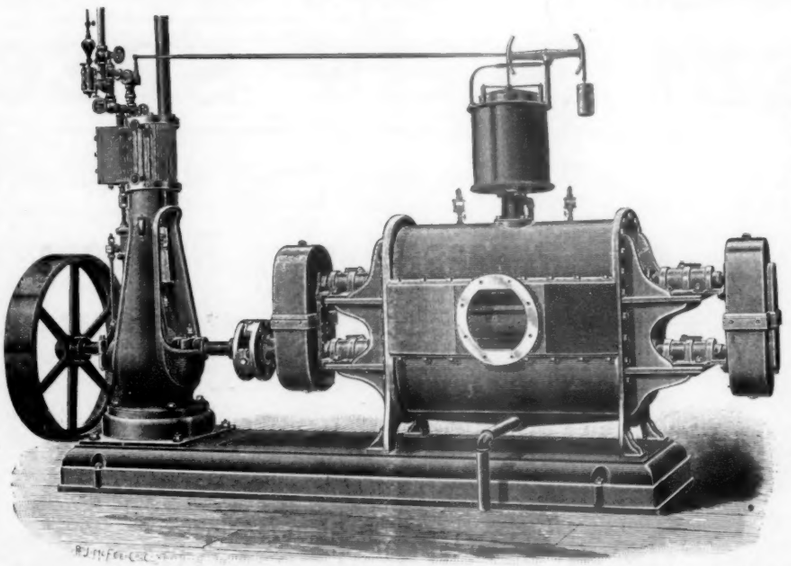

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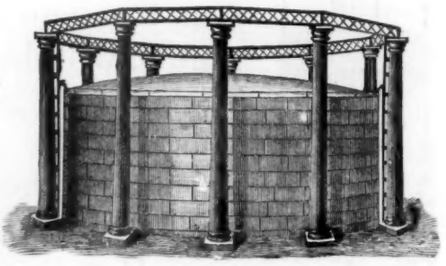

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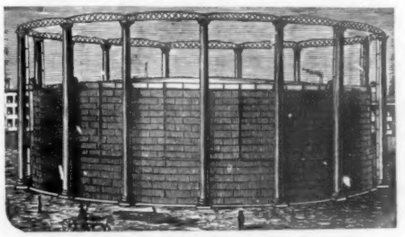
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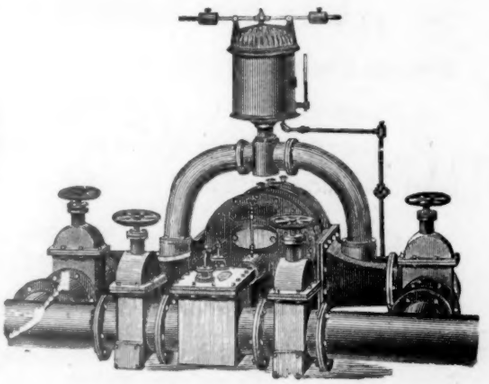

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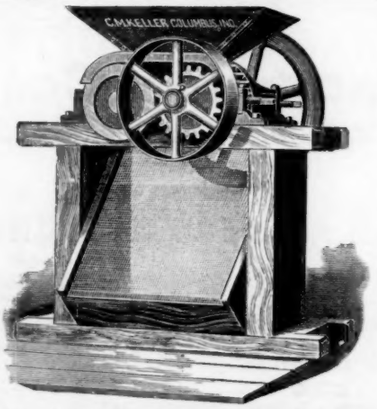

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In Theory the Otto Gas Engine realizes 18 per cent. actual work out of number of heat units in fuel consumed, while the ordinary steam plants reach but 12 per cent. **In Practice** a comparison of cost in dollars and cents between gas and steam power stands as follows (the figures below being taken from actual experience):

50-H.P. STEAM ENGINE AND BOILER, Running a Plant of Fifty 2000-C.P. Arc Lamps 12 Hours.	
4,500 lbs. Indiana nut and slack, at $1.30 per ton	$2 93
Engineer, one night, at $50 per month	1 67
Trimmer, one day, at $40 per month	1 33
Superintendent or Electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05
Water rent, one day, at $40 per year	11
Wheeling coal and removing ashes, at $4 per week	58
100 pairs carbons, at $18.50 per 1000	1 85
One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$10 38

50-H.P. OTTO GAS ENGINE, Running a Plant of Fifty 2000-C.P. Arc Lamps 12 Hours.	
9,200 cu. ft. gas, at 42 cts. per M. (for cost of gas see items below)	$3 86
Engineer not needed; engine is in care of Electrician or Supt.	....
Trimmer, one day, at $40 per month	1 33
Superintendent or electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05
Water rent dispensed with (cooling water used over and over)	....
Handling of coal included in cost of gas	....
100 pairs carbons, at $18.50 per 1,000	1 85
One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$8 95

Expenses of depreciation, repairs, and interest omitted, being considered the same in both cases—though depreciation and repairs are much higher with steam on account of boiler and its appurtenances. Cost of gas in the holder we estimate for most of the Middle and Western States as follows: Coal, 30 cts.; labor, 20 cts.; purification, 2 cts.; total, 52 cts. Less coke, 7 cts., and tar, 3 cts.; leaving net cost of gas 42 cts. The items of Superintendence and repairs, being paid for by the gas sold to consumers, need not be charged on extra output for gas engine consumption. Where the cost of gas is higher than here figured, coal for steam use will be found proportionally higher, and final figures of comparison show same amount of saving.

Excess in Cost of Steam over Gas Power is thus $1.43, or nearly 16 per cent.

Coal for getting up steam and banking fires is not included in above figures, and should be added, thus increasing rate of economy of gas power beyond that shown by our figures.

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